FORT UNION COAL REGION

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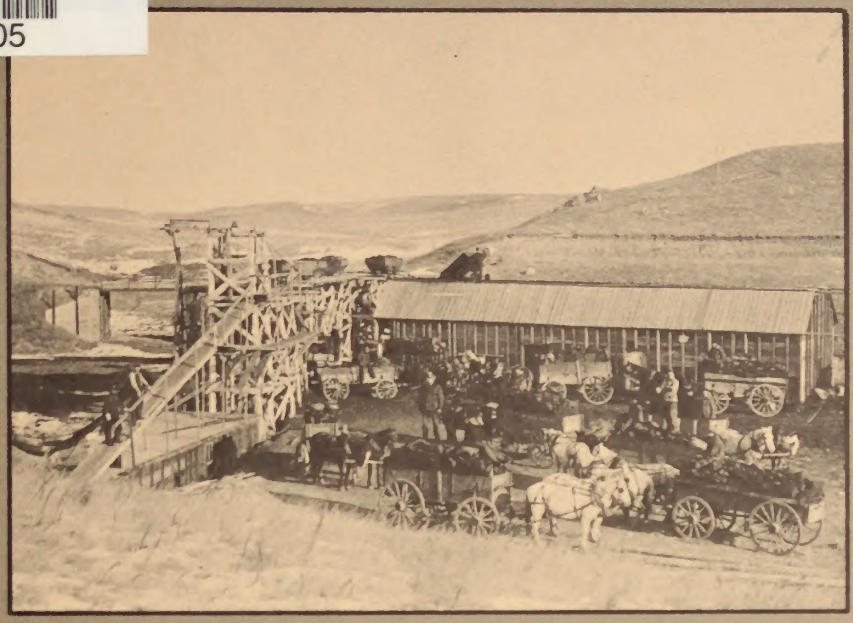

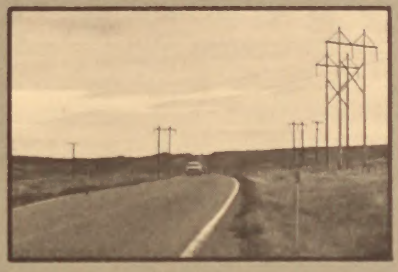

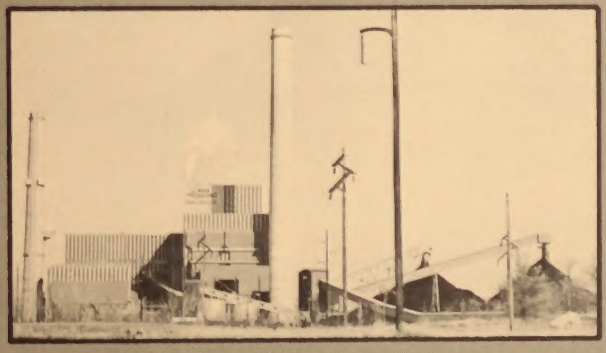

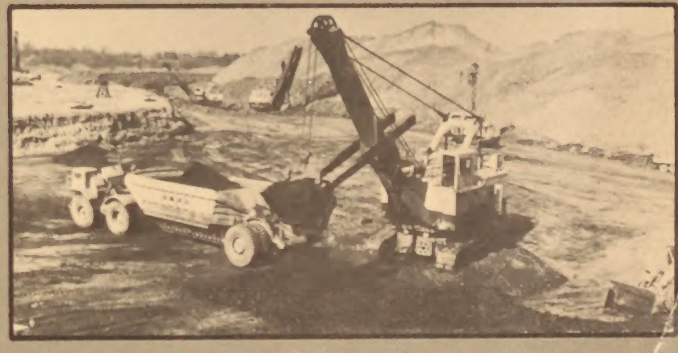

U.S. Department of the Interior
Bureau of Land Management

July 1982

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

Historical mining cover photo courtesy of Mrs. Bess Stevens and the Nokota Company

United States Department of the Interior
Bureau of Land Management

DRAFT

Fort Union Coal Regional Environmental Impact Statement

July 1982

Prepared by

Bureau of Land Management
Montana State Office
Billings, Montana

Michael J. Penfold

STATE DIRECTOR

IN REPLY REFER TO

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
222 North 32nd Street
P.O. Box 30157
Billings, Montana 59107

July 1982

Dear Reader,

The Fort Union Regional Coal EIS is proposed for your review and comment. The document describes six alternatives; the preferred alternative, recommended by the Regional Coal Team, and five other alternatives. The alternatives consist of various tract mixes which were established to make available different levels of coal tonnage. These levels range from no leasing to leasing all the available tracts. The six alternatives are described in Chapter 1, and the environmental consequences of leasing each alternative are described in Chapter 3. Due to the complexity of the computer model, parts of the air quality section will not be completed for this document; however, it will be sent in late August to everyone who receives this draft EIS.

Written comments from interested citizens, industry, and public agencies will be accepted until October 8, 1982. Comments should be sent to David Darby, Project Manager, Fort Union Project, Bureau of Lnad Management, 222 North 32nd Street, P.O. Box 30157, Billings, Montana 59107.

After the comments have been reviewed, a final environmental impact statement will be prepared. Unless the changes are extensive, the final statement may consist of only the comments, responses to the comments, and errata sheets to update the information contained in the draft; therefore, interested persons shouls retain their copies of the draft EIS.

Both public meetings and formal hearings are scheduled for public information and participation. The public meetings will be informational in nature—designed to answer any questions regarding this draft EIS. Those people who cannot attend the public meetings can visit the Dickinson or Miles City District Offices during regular business hours.

During the formal hearings, both written and oral testimony will be accepted. Please try to keep your oral testimony limited to ten minutes. Written comments can also be sent directly to the project staff (address listed above).

The public meetings and formal hearings have been scheduled as follows:

Public Meetings

Bismarck, North Dakota — 1:00 - 3:00 p.m. Central Daylight Time, August 24, 1982
Legislative Room of the new wing of the State Capitol

Hazen, North Dakota — 7:00 p.m. Mountain Daylight Time, August 24, 1982
City Hall

Circle, Montana — 7:30 p.m. Mountain Daylight Time, August 31, 1982
Vets Club

Wibaux, Montana — 7:30 p.m. Mountain Daylight Time, September 1, 1982
Wibaux County Courthouse

Formal Hearings

Beulah, North Dakota — 7:30 p.m. Mountain Daylight Time, September 28, 1982
Civic Center

Glendive, Montana — 7:30 p.m. Mountain Daylight Time, September 29, 1982
Dawson County Courthouse, Community Room

Testimony received through written or oral comments at the formal hearings will be considered during the preparation of the final environmental impact statement. No decision on the proposed lease sale will be made until the final environmental impact statement is completed.

Sincerely yours,

Michael J. Penfold

Michael J. Penfold
State Director

FORT UNION COAL REGION
ENVIRONMENTAL IMPACT STATEMENT

(X) Draft ( ) Final

Lead Agency

U.S. Department of the Interior, Bureau of Land Management

Types of Action

1. Administrative (X) Legislative ( )

2. Abstract

This statement assesses the environmental consequences of six alternative levels of coal development, plus discussions of developing the Woodson PRLA and the Meridian Exchange Proposal. The alternatives range from leasing 203.2 million tons of federal coal (7 tracts) to leasing 1,874.6 million tons of federal coal (22 tracts). The statement analyzes the impacts that would occur in Custer, Dawson, Fallon, Garfield, McCone, Prairie, Richland, Roosevelt, Valley, and Wibaux counties in Montana and Burleigh, Dunn, Golden Valley, McKenzie, McLean, Mercer, Oliver, and Stark counties in North Dakota as a result of coal leasing and development associated with the alternatives.

3. The six alternatives and their analyses are presented for public review in this DEIS. The document is the text, plus a supplemental report on air quality to be issued in August, 1982. The location of the DEIS study area as shown on Map 1 in the map packet.

4. For further information regarding this statement contact:

David Darby
Project Manager, Fort Union Coal Project
Bureau of Land Management
222 North 32nd Street
P.O. Box 30157
Billings, Montana 59107
(406) 657-6632

SUMMARY

This Draft Environmental Impact Statement (EIS) discusses the proposed leasing of seven production maintenance/by-pass and seventeen new production coal tracts in eastern Montana and west-central North Dakota. These tracts involve the leasing of federal coal administered by the Bureau of Land Management to meet the leasing target of .8 to 1.2 billion tons of federal coal as established by the Secretary of the Interior.

The Regional Coal Team (RCT) formulated six alternatives, with the seven production maintenance/by-pass tracts being the first alternative. This alternative is included in each of the five remaining alternatives. The Woodson PRLA and the Meridian Exchange Proposal are also discussed in conjunction with Alternative 3. These alternatives are analyzed with emphasis on the significant issues and impacts. Site Specific Analyses (SSAs) and Preliminary Facility Evaluation Reports (PFERs) were prepared for each tract and served as the basis for tract ranking and alternative formulation by the RCT.

Alternative 1, 203.2 million tons of new federal coal, would consist of seven production maintenance/by-pass tracts. No new mines or facilities are associated with these tracts. The air quality analysis is to be completed for distribution in August. However, the Prevention of Significant Deterioration (PSD) Class I increment is considered to be consumed at the present. There are no major changes expected from the continued mining by existing operators for water, agriculture, land use, economic and social conditions, and recreation. Cultural sites in the Glenharold tract have regional significance and may require special attention. Wildlife habitat would be decreased. No federal action would not change the impacts associated with this alternative since mining would continue at existing operations.

Alternative 2, 548.4 million tons of new federal coal, is also expected to show that the PSD Class I increment is consumed as it will be in the rest of the alternatives. Dunn Center tract may be reduced to protect Spring Creek alluvial valley floor and the groundwater supply. Dickinson, North Dakota, will need additional community supply and storage. Individual agricultural operators may be severely impacted. Crop losses for the region will be less than one percent. Wildlife impacts become more severe as more coal acreage is mined. The Knife River Flint Quarries associated with the Dunn Center tract contain important and irreplaceable cultural information. Outdoor recreation demand would increase commensurate with population increase in all alternatives. Significant population influxes would cause inflationary pressures and cause fiscal problems with specific communities. Impacts to the social organization would be substantial, permanent, and intensive.

Alternative 3, 827.2 million tons of new federal coal, would provide stress on transportation routes in North Dakota, add Fort Peck Reservoir as a water source, and cause additional economic impacts to specific communities in addition to those discused in previous alternatives. Rapid development related population increases could result in severe public service funding problems, accelerated impacts to the social organization, and hamper the ability of the communities to respond.

Alternative 4, 853.9 million tons of new federal coal, would also have the impacts of previous alternatives. In addition, the Zenith tract could cause degradation of surface and subsurface water along the Heart River. Patterson Lake water quality will also be degraded. Economic and social impacts would be similar to previous alternatives except that the makeup of the individual communities affected would vary.

Alternative 5, 1,101.0 million tons of new federal coal, would result in the Redwater II tract completely destroying a portion of the Redwater River valley. Impacts similar to previous alternatives would also occur.

Alternative 6, 1,671.4 million tons of new federal coal, could force Circle, Montana, to change their source of municipal water supply. The Redwater I tract would further impact the Redwater River valley. The impacts discussed in previous alternatives would also occur in this alternative.

The Woodson PRLA would provide for a slight increase in social and economic impacts over those of Alternative 3. Meridian Exchange Proposal may force Circle, Montana, to switch sources for their municipal water supply. Depending on the size of the conversion facility the variation in the social and economic impacts would be lower or higher than those of Alternative 3.

The RCT Preferred Alternative was Alternative 3 modified by removing the Central Bloomfield tract and substituting the Bloomfield tract. This alternative would make 832.8 million tons of new federal coal available and would have impacts as described for Alternative 3.

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ACRONYMS

ACHP	Advisory Council on Historic Preservation
ANG	American Natural Gas Company
BLM	Bureau of Land Management
DEIS	Draft Environmental Impact Statement
DOE	Department of Energy
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
FCLAA	Federal Coal Leasing Amendments Act of 1976
FLPMA	Federal Lands Policy and Management Act of 1976
LMU	Logical Mining Unit
Meridian	Meridian Land and Mineral Company
MDU	Montana Dakota Utilities
MLA	Mineral Leasing Act of 1920
MLAAL	Mineral Leasing Act for Aquired Lands
MMS	Minerals Management Service
NEPA	National Environmental Policy Act
OSM	Office of Surface Mining
PFER	Preliminary Facility Evaluation Report
PLMU	Preliminary Logical Mining Unit
PRLA	Preference Right Lease Application
PSD	Prevention of Significant Deterioration
RCT	Regional Coal Team
SCS	Soil Conservation Service
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SMCRA	Surface Mining Control and Reclamation Act of 1977
SSA	Site Specific Analysis
TDS	Total Dissolved Solids
TR	Theodore Roosevelt National Park
TSP	Total Suspended Particulates
USGS	United States Geological Survey

INTRODUCTION

Fort Union

PURPOSE AND NEED

In 1979, the Secretary of the Interior approved a new federal coal management program. The decision followed the completion of a national environmental impact statement (EIS) on the leasing of federal coal reserves which dealt with alternative types of programs. The regulations issued to implement this program are presently being revised, but the revisions do not substantially change the framework of the program.

The four major aspects of the new federal coal program are as follows:

1. Federal coal will be managed and leased primarily on a regional basis through regional coal sales; however, there will be some areas where coal will be leased by application and these areas are now being delineated.

2. The amount of coal leased in any one of the eleven coal regions is based in part on market demand and the desire for coal reserves to produce energy, and actual production is insured in part by diligent development requirements. This means that coal will be leased to actively serve national energy requirements, and not just as a response to individual companies.

3. Regional Coal Teams (RCTs), consisting of the Governor in each state within a coal region, Bureau of Land Management (BLM), other federal agencies, state agencies, and local officials, have been established to help guide the federal coal management program efforts and to offer advice to the Secretary of the Interior.

4. Environmental factors play a substantial role in deciding which tracts would be leased in a given lease sale. National Environmental Policy Act (NEPA) dictates would be complied with both by evaluations of each coal tract under consideration (site-specific analyses) and the regional cumulative consequences of overall coal sale options (Regional EIS). The site specific analyses (SSAs) are available upon request from the Montana State Office.

Under the new program, an agreement to establish the Fort Union Regional Coal Team was signed by Governor Arthur Link of North Dakota and Governor Thomas Judge of Montana, as well as BLM Director Frank Gregg in April 1980. The Fort Union RCT organization is in Figure 1. Subsequently, the Secretary of the Interior set a first coal lease sale date for the Fort Union Coal Region of June 1983. The Fort Union Coal Project follows the necessary major elements in the new Federal Coal Program (see Figure 2).

FIGURE 1
FORT UNION REGIONAL COAL TEAM

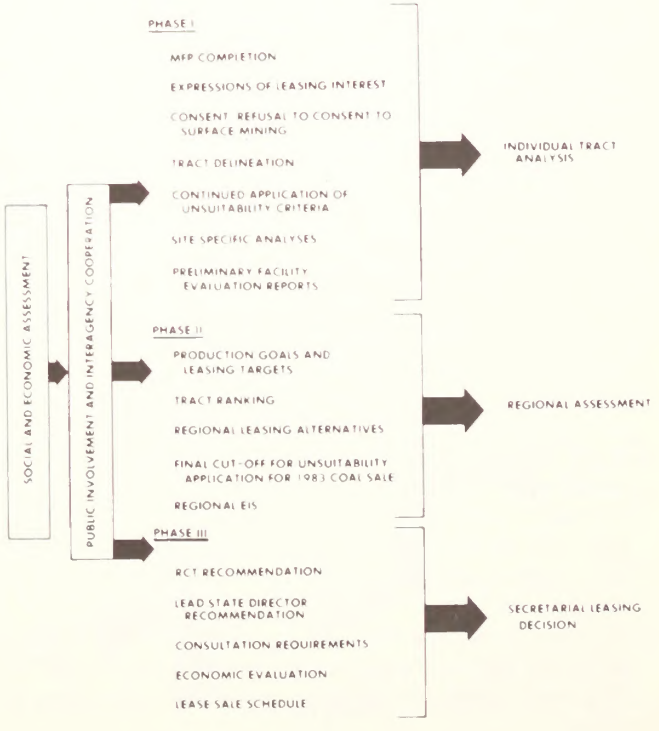
CHAIRMAN
Clair Whitlock
Idaho State Director, BLM

BUREAU OF LAND MANAGEMENT Michael Penfold Montana State Director	STATE OF MONTANA Tim Gallagher Governor's Representative
BUREAU OF LAND MANAGEMENT Chuck Steele Dickinson (ND) District Manager	STATE OF NORTH DAKOTA August Keller Governor's Representative

EX-OFFICIO MEMBERS

U.S. FISH & WILDLIFE SERVICE Gill Key	ENVIRONMENTAL PROTECTION AGENCY Ken Alkema
OFFICE OF SURFACE MINING Bill Thomas	GOLDEN VALLEY COUNTY COMMISSION Keith Farstveet
MINERALS MGMT. SERVICE Dwayne Hull	RICHLAND COUNTY PLNG. COMMISSION Nancy Fishering
	GARFIELD COUNTY COMMISSION Ken Coulter

FIGURE 2
MAJOR ELEMENTS: FORT UNION COAL PROJECT



Following completion of three BLM land use plans within the region (Redwater, Golden Valley, and West-Central North Dakota), interest in coal leasing was solicited from the public. In addition, persons or groups owning the surface over federal coal reserves were offered the opportunity to refuse to allow mining of the coal in exercise of their right under the Surface Mining Control and Reclamation Act of 1977 (SMCRA). An interagency group of federal and state officials then evaluated the refusals, the interest in leasing and development, likely energy needs for the region, environmental problems, and other factors in identifying specific areas to evaluate further for the 1983 lease sale (see Figure 3). These areas were then identified to the Conservation Division of the U.S. Geological Survey (USGS) for their delineation into logical mining units or tracts for development. These functions are now being handled by the Minerals Management Service (MMS). The result was a focus on 24 specific tracts within the coal region. The tracts contain varying percentages of private, state, and federal coal, and the boundaries were drawn to permit a mine and its associated facility to operate for 30-50 years. The tract boundaries were also drawn to indicate where federal coal will be offered for lease, but the analysis of the impacts of mining will include the whole tract and not just the federal coal.

Sixteen of these coal tracts would entail a new mine and would constitute new coal production, one was set aside for lease to a small business enterprise only, and seven tracts were identified where federal coal would be needed for production maintenance or be by-passed by an existing mining operation if it were not leased. Individual site evaluations (SSAs) were completed on all 24 tracts in June 1981 and made available for public review.

On November 18, 1981, Assistant Secretary of the Interior Garrey Carruthers set a preliminary final leasing target range for the 1983 sale of federal reserves of somewhere between .8 and 1.2 billion tons of recoverable coal. The actual level of development will be determined through federal and state review of individual mining plans and plant siting applications. The need for additional federal coal leasing was established and documented in the 1979 National Federal Coal EIS, the analysis which went into that EIS, and the Department of Energy production goals. The level of actual need within a specific coal region is still subject to the uncertainties of future projections of coal demand and the environmental acceptability of conversion technologies and development levels. Ultimately, economic market forces and the demand for synfuel will determine which tracts will be developed.

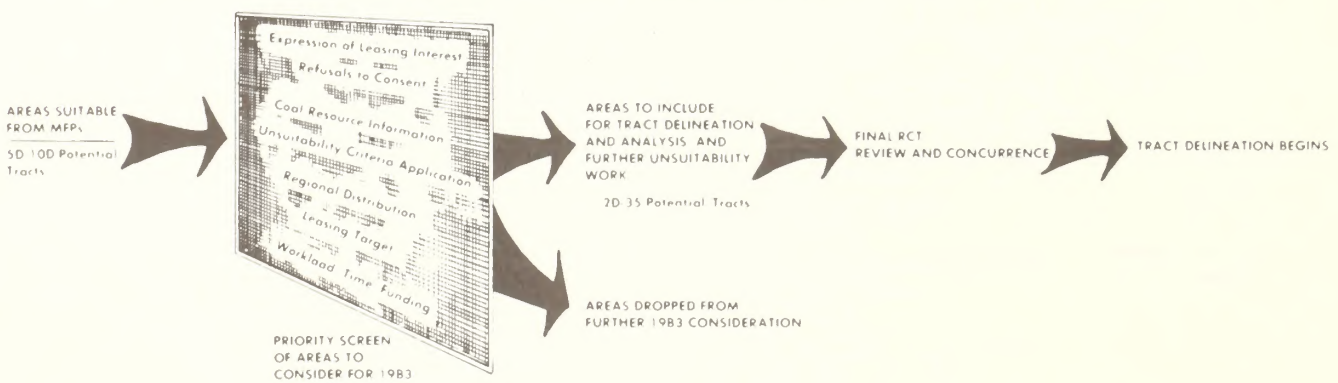
The purpose of this analysis is to look at the consequences of leasing and development of federal reserves in compliance with the federal coal management regulations and NEPA. It evaluates various levels of leasing and development. At its meeting on December 8-9, 1981, the Fort Union RCT ranked the 17 new production tracts in terms of their desirability for leasing and development. They ranked the tracts 1-17 in terms of "most desirable" to "least desirable," and later categorized the tracts into "high," "medium," and "low" desirability groupings (see Table 1). Using the tract ranking as one among several factors, the RCT established six alternative leasing patterns for the 1983 sale to be analyzed for their cumulative effects.

There are three key points in understanding the analysis reflected in the Fort Union Coal Regional EIS:

1. The consequences of developing all of the coal reserves within a tract are analyzed, even though in some cases the location of federal reserves within the tract may not control whether or not development of the tract occurs.

2. The development of a coal conversion facility (power plant or synthetic fuel plant) is analyzed with each tract representing new production. This analysis is done at a general level and is not meant to supercede the various facility permitting processes in both North Dakota and Montana, but to give the RCT a better

FIGURE 3
IDENTIFICATION OF AREAS TO BE EVALUATED IN 1983 LEASE SALE



understanding of what federal leasing might imply for future development within the region. The RCT specifically requested this type of information to assist in offering advice on how many and which tracts to recommend for leasing.

3. The analysis for each alternative will assume that all tracts would be leased and developed. It is unlikely that in any of the alternatives either market considerations or the record of business success would lead to every lease tract being developed. The characteristics accompanying industrial development are nevertheless reflected at their highest level, even though what may realistically be expected for the region probably falls short of this in any given alternative.

TABLE 1*

REGIONAL COAL TEAM DECISIONS ON TRACT RANKING AND LEASE DESIRABILITY

Tract	Ranking Number	Leasing Desirability
Truax	1	H
South Wibaux-Beach	2	H
Burns Creek	3	H
Sakakawea	4	H
Circle West I	5	H
Bloomfield	6	M
North Wibaux-Beach	7	M
Werner	8	M
Southwest Glendive	9	M
Dunn Center	10	M
Circle West III	11	M
Garrison	12	M
Circle West II	13	M
Central Bloomfield	14	L
Redwater I	15	L
Redwater II	16	L
Zenith	17	L

*See Appendix K for complete tract ranking.

Fort Union Regional Coal Team Meeting

REGIONAL SETTING

The Fort Union Coal Region covers the eastern quarter of Montana and the western part of North Dakota (see Map 1 in Map Packet). Fort Union was the name given by the USGS to a vast geological formation containing coal beds located primarily in Montana and North Dakota. The entire region was named for the coal outcroppings in the vicinity of historic Fort Union, located near the present town of Buford in Williams County, North Dakota. The Missouri Plateau extends from the Missouri Coteau, an escarpment, westward to the Rocky Mountains. Within this area the land consists of rolling prairie, badlands, and isolated buttes and mesas.

Numerous coal deposits of economic value are found throughout the region considered for leasing. In Montana the principal deposits are Circle, Burns Creek-Thirteen Mile Creek, Southwest Glendive, and Wibaux-Beach; and in North Dakota the deposits are Dickinson, Zap, North Beulah, Renner's Cove, Hazen, Washburn, Underwood, Garrison, North Garrison, Dunn Center, South Beulah, and Stanton-Center. The coal beds of economic interest in this region occur primarily in the Tongue River and Sentinel Butte members of the Fort Union formation. There are other beds in other formations, but they are generally too thin, impure, or discontinuous to be of economic interest.

Historically, both federal and state governments have disposed of surface holdings while reserving varying percentages of subsurface minerals beneath these holdings. This activity has produced a checkerboard pattern of coal ownership. An evaluation of the coal reserves for the 24 tracts shows that individual tracts contain from 3 percent to 48 percent federal coal. Generally tracts with the smallest percentage of federal ownership are located in the eastern part of the region. State ownership varies between states. In the Montana tracts, state ownership ranges from 1 percent to 19 percent, whereas in North Dakota, state ownership ranges from 2 percent to 24 percent. The largest private owners of coal are the Federal Land Bank and Burlington Northern, Inc., and private ownership in the tracts ranges from 33 percent to 93 percent.

Although electrical demand has moderated compared to recent years, planning for power plants and other coal development is continuing. The reduced demand for electricity has resulted in some slowdown of planning and permitting schedules for power facilities, but this trend could change should increased interest in synthetic fuel development result in new synthetic fuel plants for the region. The interest in synthetic fuel development in the Fort Union Coal Region is apparent from the expressions of interest in coal for synfuel facilities, and evaluations are currently being made of the region and its resources to determine the desirability and level of development. Many of these plans and

evaluations will remain in the preliminary stages pending the future financial and political climate for synfuel development.

The Nokota Company's proposed synthetic liquid fuels plant, proposed specifically in conjunction with coal development associated with the Dunn Center tract, will be the subject of a specific EIS in the near future. The Bureau of Reclamation has been selected as the lead federal agency to prepare this EIS, based upon their potential role in marketing water reserves connected with the proposal. Efforts are ongoing to insure coordination between this regional EIS and the specific effort connected with the Nokota proposal. There is no commitment to Nokota to lease this tract. If the tract is selected for leasing, it will be open for competitive bid.

USE OF LIGNITE COAL

The coal in the Fort Union Coal Region is ranked as lignite in the classification system of the American Society for Testing and Materials. The heating values of lignite range from about 5950 to 7510 British thermal units per pound, and the moisture content of lignite is in the 30-40 percent range. Like most lignite coals it crumbles to fine particles quickly on exposure to the air and can ignite spontaneously.

These qualities of the lignite in the Fort Union Coal Region generally ensure that it will be used on-site. Most of the conversion of the lignite in the region is utilized in mine-mouth facilities because it has generally been found to be uneconomical to transport the lignite any major distance. At the present time, Fort Union lignite is transported about 365 miles from a mine in North Dakota to a power plant in South Dakota. It was assumed, therefore, that each new mine associated with a new production tract would entail a new coal conversion plant in the vicinity of the mine.

ENERGY DEMAND AND LEVEL OF DEVELOPMENT

In 1980, the Department of Energy (DOE) projected that the annual coal production goal for the Fort Union Region could be between 53.9 million and 105.9 million tons by 1995. The DOE projections of future coal production were based on the assumption that federal and nonfederal coal reserves would be available to meet forecasted demands. Federal coal ownership, in a scattered checkerboard pattern, accounts for approximately 35 percent of the coal being studied for the 1983 sale. The Department of the Interior used the DOE projections as an aid in identifying how much of the DOE projection should be federal coal and ultimately the total that would be offered for sale. RCT recommendations were made on a preliminary leasing target, and in a memorandum dated December 19, 1981, Assistant Secretary of the Interior Carruthers announced a final leasing target of 0.8 to 1.2 billion tons of federal coal.

The Assistant Secretary made this decision with the understanding that the Interior Department may alter this level if it is necessary. The Assistant Secretary felt that this level would insure free competition and compensate for unexpected demand or shortfalls in supply. This target will give industry greater flexibility in planning and creates a pool of reserves in advance of planned production to allow for strategic planning by industry. The Assistant Secretary also felt that the higher target would insure easy access into the coal industry. It is unlikely that all the tracts available will be leased; in fact, the final decision on which tracts will be available will be made by the Secretary of the Interior when the sale schedule is announced. If 1.2 billion tons of federal coal are leased and mined, the maximum annual production would be 128.6 million tons of federal, state, and private coal. If 0.8 billion tons of federal coal are leased, the maximum annual production rate would be 80 million tons of federal state, and private coal. This compares to 18.4 million tons of production in 1981.

An additional 203.2 million tons of federal coal, not included in the leasing target, will be considered for the sale in 1983. This federal coal would be used by existing mining operations to maintain production or be bypassed.

AUTHORITIES FOR COAL LEASING AND DEVELOPMENT

This section presents an overview of the major laws and regulations of the federal and state agencies which influence the development of federal coal resources. Primary emphasis is on statutes which directly control leasing and mining activities. Other authorities such as major facility siting, air and water quality, and archeology are cited in Appendices A and B to provide a perspective on factors which may indirectly influence the demand for coal resources and the location and intensity of coal development and related activities.

The following is a chronological listing of the major statutes and their purposes as related to coal leasing and mining activities.

1. Mineral Leasing Act of 1920 (MLA)

This act provided that deposits of coal, phosphate, potassium, oil, oil shale, gas, and sodium could be acquired through a leasing system. This law specifies, among other things, minimum royalties, acreage limitations, and the term required for each kind of leasable mineral.

2. Federal Coal Leasing Amendments Act of 1976

The broad purpose of the FCLAA is to provide a more orderly procedure for the leasing and development of coal presently owned by the United States. Among the most significant requirements of the FCLAA governing the award and development of federal leases are the following:

All leasing must be by competitive bidding; no bids can be accepted which do not equal or exceed fair market value.

Issuance of prospecting permits leading to non-competitive (preference right) leasing is abolished (subject to valid existing rights).

Leases may be consolidated into logical mining units (LMUs) when needed to insure maximum economic recovery of the coal deposit; all LMU reserves must be mined within 40 years.

Diligent development and continuous operation is required (except continuous operation may be waived upon payment of advance royalties).

Leases to a single entity are limited to 100,000 acres nationwide (as well as 46,080 acres in a particular state).

State shares of royalties were raised from 37 1/2 percent to 50 percent with the new portion of the monies available not just for construction of roads and schools but also for a wide range of specific services and facilities in impacted areas.

Public bodies were entitled to have reserved a reasonable number of leasing tracts for their own energy production.

3. Federal Lands Policy and Management Act of 1976 (FLPMA)

The purpose of FLPMA is to provide the first comprehensive statutory statement of purposes, goals, and authority for the use and management of federally-owned lands administered by the Secretary of the Interior through the Bureau of Land Management. FLPMA provided for the following basic items:

Statutory framework for land-use planning for public lands.

Confirmed that the BLM may continue to rely on existing plans.

Liberalized the use of mineral revenues by states and local governments by providing that the entire 50 percent of the funds received by the federal government for the development of leasable minerals on federal land could be used for any public purpose and by establishing a program to provide low interest loans to states and local governments to be impacted by federal land mineral development activities.

The Interior Department is required to review all BLM roadless areas of 5,000 acres or more and roadless islands for potential designation as wilderness.

4. Surface Mining Control and Reclamation Act of 1977 (SMCRA)

This Act was passed in response to concern over the extensive environmental damage caused by coal mining and due to technological and economic changes which now favor surface over underground mining. SMCRA established uniform minimum federal standards for regulating surface mining and reclamation activities throughout the country on federal, state, and private lands, and for assuring adequate protection from the environmental impacts of surface mining in all states.

Other features of SMCRA relevant to the leasing and development of coal are:

Authority to exchange federal lands already under lease but which have been included in an alluvial valley floor and are subject to the grandfather clause in Section 510(b)(5) of the Act.

A requirement for the consent of certain private surface owners before the Department can lease any federal coal under privately-owned land.

5. Mineral Leasing Act for Acquired Lands (MLAAL)

MLAAL governs leasing on federally-acquired lands for coal as well as other minerals covered by the Mineral Leasing Act. This Act requires the consent of the head of the federal agency having administrative jurisdiction over the acquired lands before BLM can lease the coal. FCLAA grants similar veto authority to the surface managing agency with regard to nonacquired lands. Otherwise, leasing provisions are the same as those for nonacquired lands.

PUBLIC INVOLVEMENT

Since the Fort Union Project's inception in April 1980, a number of steps have been taken to insure that the public's views were considered at key stages of the coal planning process. The Fort Union RCT approved a number of actions which went beyond the basic regulatory requirements in order to insure that these objectives were met.

These actions have included general public mailings, meetings throughout the region, hearings, information

Fort Union Coal Region Public Meeting

brochures and newsletters, solicitation of public comment at RCT meetings, and the publication and distribution of a variety of reports for public comment. This draft environmental impact statement released for public review and comment is one more step in the process.

In addition to the above steps, the RCT has insured that a number of regulatory steps have been complied with including Expressions of Leasing Interest, contact with surface owners, formal testimony on the federal leasing target, and DOE production goals. The public response to these regulatory steps was considered in decisions by the RCT, such as, which coal tracts to continue to evaluate for the 1983 lease sale and which issues to focus on in the regional EIS.

Affects on agriculture, social and economic concerns, and potential problems with air quality connected with coal development were three major issues which surfaced. These are just three areas where public views and concerns have led the BLM to fund and the RCT to approve special data collection and analysis. Agricultural impacts were the subject of an extensive contract looking at effects on agricultural operations. Two separate economic and demographic modeling efforts have been conducted, first for the SSAs and more recently for the regional leasing alternatives including acquisition of a regional economic demographic model by BLM. An extensive air quality contract was undertaken by a firm in California to assess the current state of the technology in areas like acid rain as well as modeling for particulates, sulfur, and nitrogen dioxide.

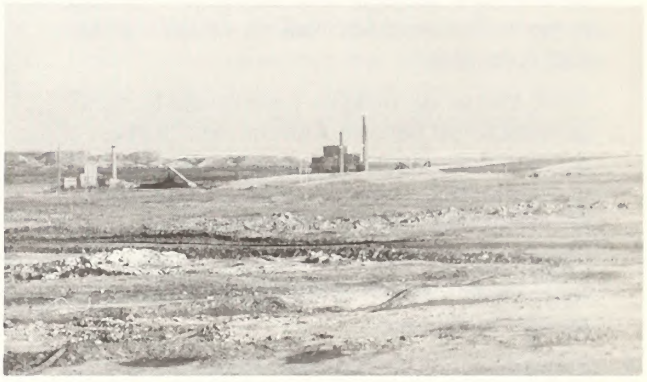
The above steps were outlined in the project management plan approved in August 1980. Some of the individual steps are described further in the consultation and coordination section of the EIS. A summary of public issues raised as a result of this involvement are summarized in the following section.

MAJOR ISSUES

As a result of public comment and consultation and EIS scoping with various groups and governmental organizations, a number of specific issues have surfaced. The following discussions will give a brief overview of the major issues which will be discussed in greater detail in Chapters 2 and 3.

Air Quality

The major issue concerning air quality in the Fort Union Coal Region is the consumption of the SO_2 increment over the Theodore Roosevelt National Park (TR) by the proposed facilities. TR is classified as a Class I area, and the Prevention of Significant Deterioration (PSD) Class I increment over the TR is close to or already consumed. Six companies have submitted PSD permit applications which the State of North Dakota will process on a first-come-first-served basis once the question of how much increment remains is answered. A study of the modeling techniques is presently underway. The present modeling technique shows the increment is consumed, while other techniques seem to show some increment still remains. As stated, the application of another model will at best show only a little increment remaining. If this is the case, then the six companies with PSD applications already submitted would easily consume the remainder. This sets the stage for the problems involved with the proposed Fort Union facilities.



Additional facilities cause concern for air quality.

The Fort Union Regional EIS is analyzing up to 13 new facilities onto the existing background. Only two of the six pending permit applications, Basin Electric Company and Nokota Company, are included in the new facilities being analyzed by this EIS. They may have a chance to get a portion of the increment that remains, but this means that the other facilities being analyzed within impact range of TR probably could not be permitted. A variance procedure is available to permit facilities above the increment, but it would seem highly unlikely that all of the facilities that impacted TR would receive a variance. Further, the degradation of air quality by the proposed alternatives is an issue in itself. The impacts on vegetation, animals, and property that could occur due to the proposed alternatives from air emissions within the standards creates a variety of issues. Foremost of these issues is the acid rain potential from the use of coal in power, liquifaction, and gasification facilities. With the degradation of air quality, secondary impacts such as the quality of life become issues.

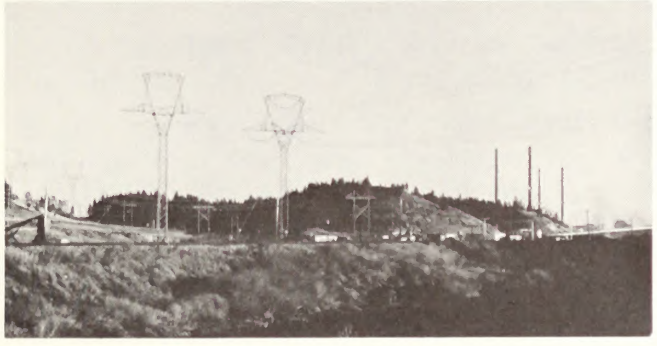
Water Quality

The main issues associated with water quality center on the groundwater supplies. Shallow groundwater is used extensively for domestic and livestock purposes and

mining could damage the quality of this supply. Some local streams are fed by groundwater and also could be impacted. The water in these streams is protected by state water quality standards and used for municipal, irrigation, and recreation purposes. Downstream from the Zenith tract is Patterson Lake which is used by the City of Dickinson, North Dakota for municipal and recreation purposes. The Zenith tract is entirely within the municipal watershed and includes within its boundaries the primary and secondary stream channels which feed Patterson Lake. Another issue is the practice of disposing of facility wastes in open mine pits and the possible effects on groundwater.

Agriculture

The agricultural issues are divided into on-site and off-site concerns with some overlapping. There is debate within the agricultural community over issues such as reclamation. The effects of gross acreage disturbance and reclamation on agriculture are the key on-site concerns. Some groups feel that reclamation of the mined land is not possible. The off-site issues are air emissions, acid rain, surface water pollution, subsurface water pollution, and aquifer damage. The acid rain issue is the concern of many states east of the facilities, and the Canadian government feels that the acid rain issue is of critical importance. Surface water pollution, subsurface water pollution, and aquifer damage are issues both on and off-site. Agricultural groups are concerned that strip mining may destroy aquifers and wells on the land still being farmed inside the tracts as well as the land outside the tracts.



Transmission line corridors affect agriculture practices and visual quality.

Reclamation

There are a number of major issues concerned with reclamation. There is debate in scientific circles over the 10 to 15 year time period needed for the replacement of various vegetative types and some people feel that the mined land can never be reclaimed to its former production capabilities. Crop and livestock production are spin-offs of this central issue. Wildlife habitat, especially wetlands, riparian, and woody draws, and whether it can be reclaimed, is a very important issue. Water quality and erosion are interrelated issues that depend upon the success of revegetating the reclaimed land.

The scientific community seems to feel that the issue is not whether the land can be reclaimed or not, but whether or not the time frames and costs involved in reclamation are accurate.

Wildlife

One major wildlife issue is the destruction of crucial wildlife habitat such as riparian areas, wetlands, and woody draws. The subsequent reductions in wildlife populations would effect fishing, hunting, photography, and other wildlife-oriented recreation. The increased human population which would accompany construction and mining would further magnify habitat destruction. The construction of roads, subdivisions, trailer courts, shopping centers, pipelines, and sewage ponds would also contribute to habitat destruction and effect wildlife populations. Increased off-road-vehicle use as well as increased traffic over existing and new roads are also problems which result from human population increases. The increase in legal and illegal killing of wildlife could effect the overall wildlife population levels, especially big game, and could decimate local populations.

Another important issue is whether woody draws and wetlands can be reclaimed. Finally, the potential pollution and subsequent destruction of aquatic life by acid rain is an issue with far reaching implications.

Cultural Features

A portion of the Knife River Flint Quarry has been declared eligible for the National Register of Historic Places. The area is proposed as a National Register District and involves part of the Dunn Center tract. The many quarry sites, workshops, and encampments are important in determining stone tool technology, prehistoric population mobility, territoriality, and trade patterns. Artifacts and raw flint materials were transported and traded throughout the mid-continental United States and Canada. Knife River Flint is easily quarried and is found as nodules in the sandy-clay glacial till of the area. One of the larger site concentrations has an estimated 25-30 quarry pits per acre.

The main issue concerning the Knife River Flint Quarry is that two sections of the proposed District fall within the tract boundaries. When the mining plan is developed, it will be determined whether these two sections are unsuitable or whether they can be mitigated and then mined.

Transportation and Rights-of-Way

The issues concerning transportation center on the increased demand on the existing network of roads and the corresponding increase in road maintenance costs, design problems, and potential for conflicting use caused by mine and facility development.

Other issues would include how the location of transmission lines, pipelines, and other utility corridors would effect existing agricultural practices and the area's visual quality (landscape character).

Public Revenues and Costs

The main issue is whether or not local governments can handle the rapid population growth associated with facility construction and mining, and the pressures that this type of rapid growth will put on public services. In general, public revenues lag behind public costs by two to three years during periods of rapid economic development. While revenues generated by population growth and economic development (e.g., property taxes, state income taxes, etc.) do increase rapidly when population levels boom, the costs associated with this growth often exceed the revenues in the first few years of development, creating funding issues which can be difficult to resolve. Examples of this are the relatively high capital costs associated with the expansion or improvement of sewage and water systems. Solutions to this issue lie in the magnitude and timing of funding availability. "Front end" financing would solve much of the lag problem, and general availability of capital equipment improvement funding at federal and state levels would reduce the overall burden on communities to provide all funding for these services from the local tax base.

Inflation

Inflationary pressure from economic development is most likely to occur in smaller, less developed trade areas where the increases in demand for housing, food, clothing, etc., strain the local supply or distribution systems. Individuals on fixed incomes experience the greatest inflationary burden although anyone not sharing in the income benefits resulting from development would also experience difficulties. Development-related inflation would occur during the relatively labor intensive construction phase of a major facility since it is during this period that large payrolls and company expenditures are injected into the local economies. However, long term inflationary impacts would also be an issue since an operation work force would be located in an area for the 30 to 40 year life of the mine/facility and individuals not sharing in the economic benefits of development would be at a relative disadvantage in competing for goods and services.

Lifestyle Changes

The basic issue concerning the lifestyle of small communities will be the long-term social changes that will occur in conjunction with coal development. Examples of this would be changes in availability of and access to resources and services, changes in the social composition and occupational character of local populations, and changes in the informal, small-town atmosphere of many communities. The change in the power and economic base of affected communities, with agriculture losing some of its dominance to industry, is also an issue; but this may be offset by the increase in local employment opportunities and the reversal of the trend of outward migration from many small communities. The distribution of benefits and development costs among present and future residents of the area could also be an issue. Another issue is the perceived impact to public health and safety from air and water pollution associated with coal conversion facilities.

Lifestyles change as a result of population influx.

Meridian Land and Mineral Company Exchange Proposal

On November 2, 1981, Meridian Land and Mineral Company (Meridian), a wholly owned subsidiary of Burlington Northern, Inc., proposed an exchange of Meridian coal in the Circle West deposit for federal coal north of Nelson Creek. Since both federal and Meridian coal are in a checkerboard pattern, Meridian believes that the exchange would be advantageous to both parties because of the consolidation of ownership that would result. The proposal would result in two mining units with approximately 350 million tons each.

Nelson Creek would be the dividing line for the exchange. Meridian would select for their needs federal coal north of Nelson Creek, and the BLM would select Meridian coal south of Nelson Creek. The Meridian proposal includes only the coal rights, however, they are not adverse to exchanging their surface rights as well, if it is in the public interest.

The public interest is the key issue in the exchange. After analyzing the public comment and other factors,

the Montana State Director, Michael J. Penfold, felt the issues clearly supported further study of the proposal.

SITE SPECIFIC ANALYSIS MODIFICATIONS

Since the September 1981 publication of the Fort Union SSAs and Preliminary Facility Evaluation Reports (PFERs), modification of tract boundaries were made on six tracts in North Dakota. The boundaries were changed as a result of more information gathered during the continuing unsuitability studies and errors made on identifying federal coal acceptable for further consideration.

Significant boundary changes were made for the Dunn Center, Werner, Renner and Garrison tracts, while lesser changes were made for the Glenharold and Underwood tracts. These modifications had the effect of changing tract acreages, coal reserves and, in some cases, the tract analysis. In most cases, tract acreage and coal reserves were reduced. These changes are reflected in the Regional impact analysis. Additional changes can be expected to occur until approximately 60 days prior to the lease sale, but they should not produce any significant changes in the analysis. The following tract maps represent current tract boundaries, surface and coal status.

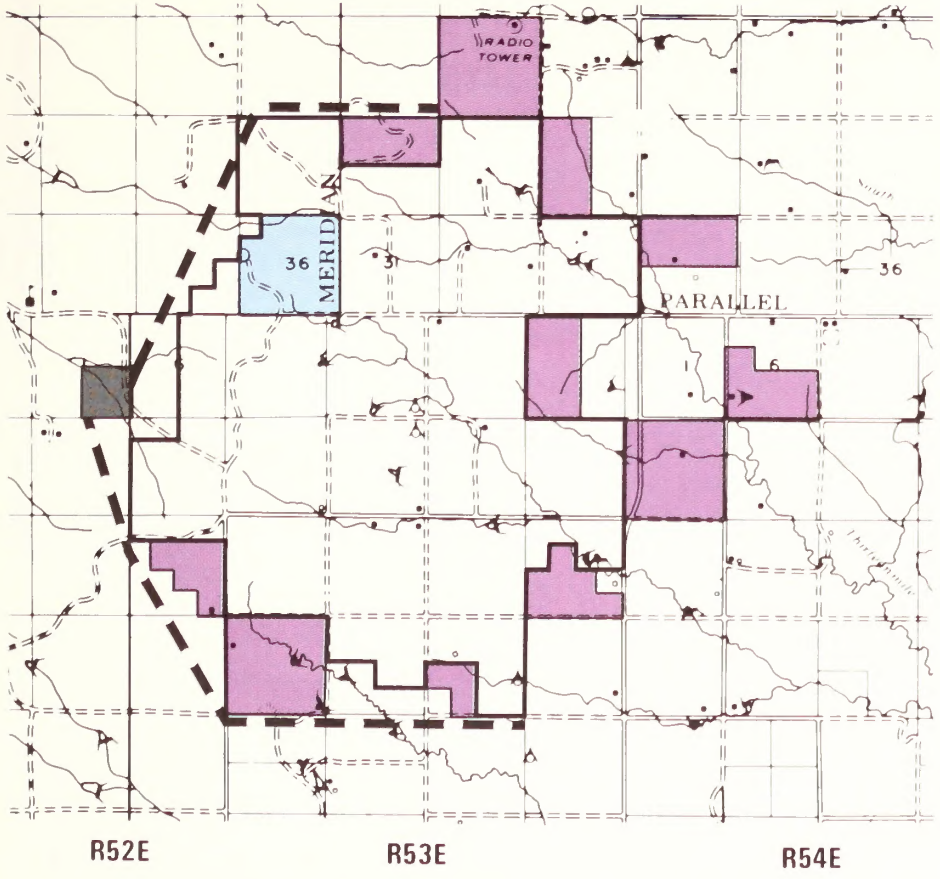
Typical Fort Union regional view.

List of Tract Maps:

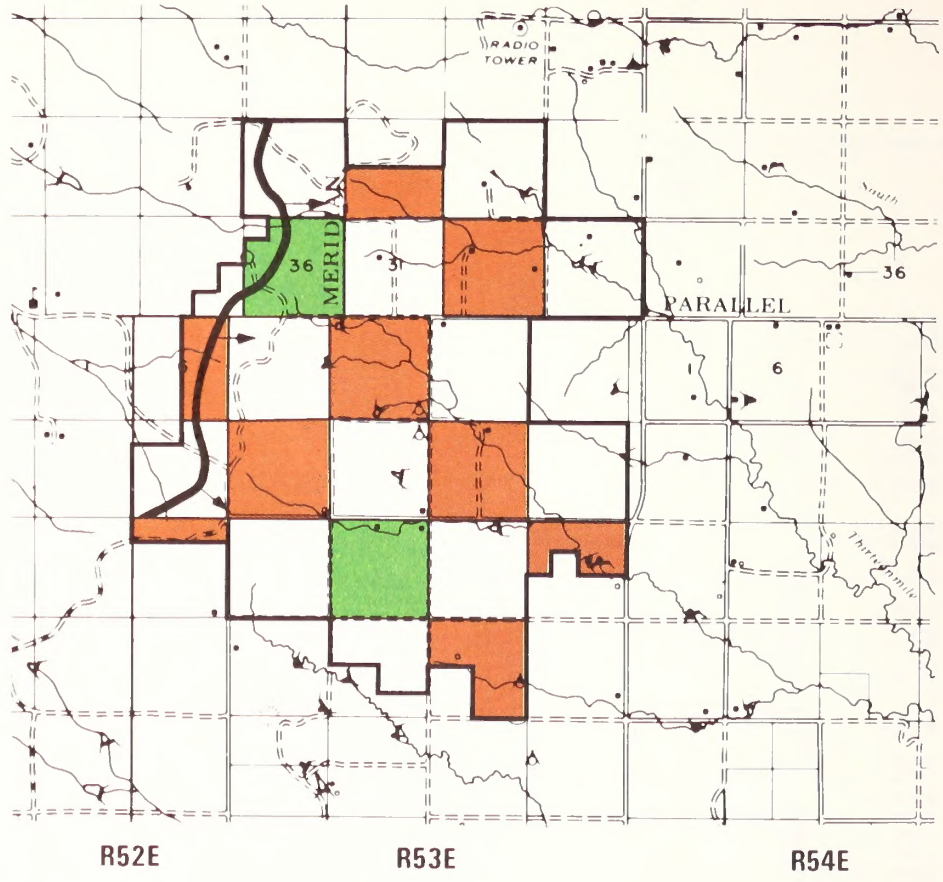
Bloomfield
Burns Creek
Central Bloomfield
Circle West I
Circle West II
Circle West III
North Wibaux-Beach
Redwater I
Redwater II
South Wibaux-Beach
Southwest Glendive
Antelope
Center
Dunn Center
Garrison
Glenharold
North Beulah
Renner
Sakakawea
Schoolhouse
Truax
Underwood
Werner
Zenith
Woodson PRLA
Meridian Exchange (BLM—Meridian)
Meridian Exchange (Meridian—BLM)

BLOOMFIELD TRACT

SURFACE



SUBSURFACE



LEGEND

- State Surface
- Private Surface
- Surface Owner Nonconsents
- Surface Facilities
- Out-of-Pit Haul Roads
- Tract Boundary

LEGEND

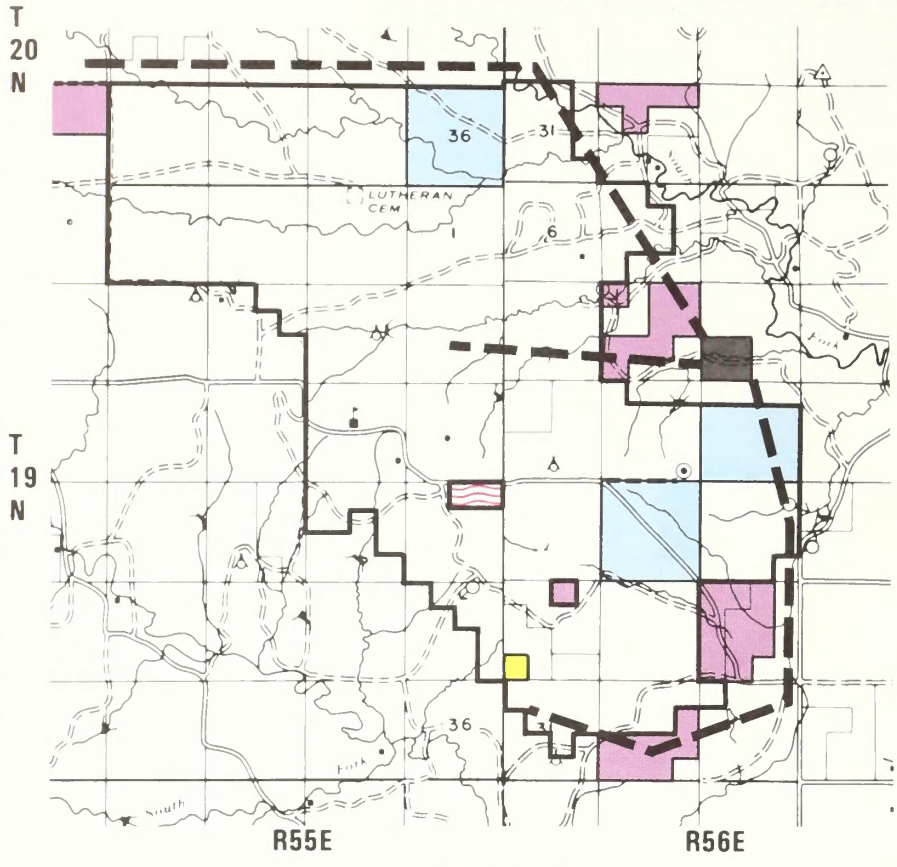
- Federal Coal (100%)
- State Coal (100%)
- Private Coal
- Pit Advancement
- Tract Boundary

N

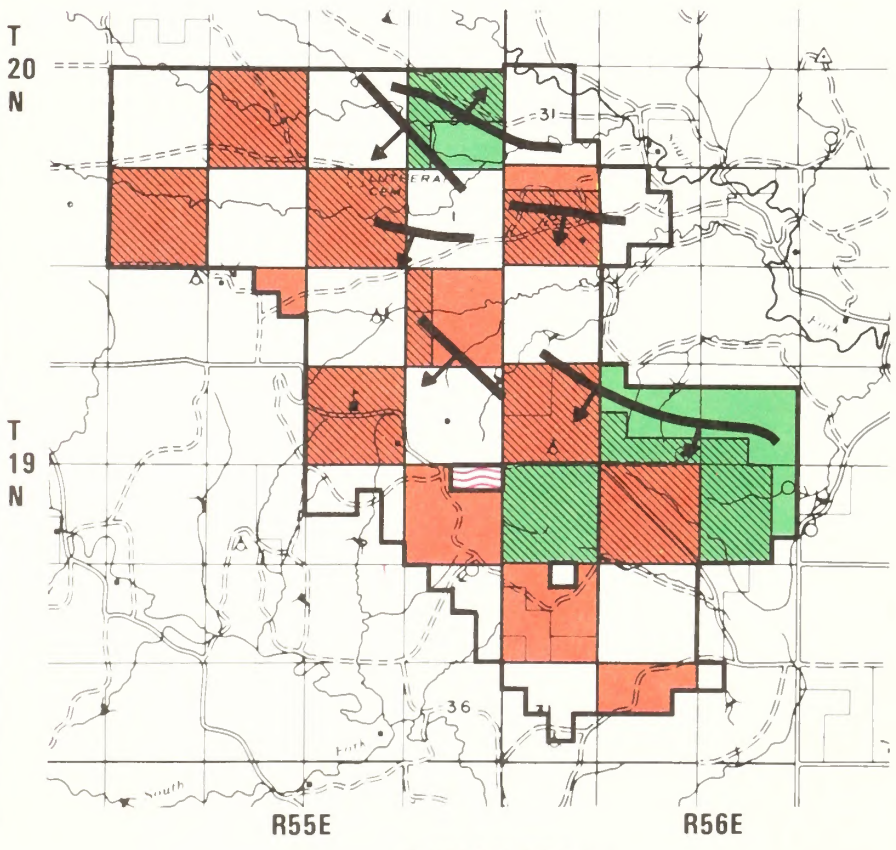
1 0 1 2 3 4 5 6

Scale In Miles

BURNS CREEK TRACT



SURFACE



SUBSURFACE

LEGEND

- Federal Surface
- State Surface
- Private Surface
- Surface Owner Nonconsents
- Surface Facilities
- Federal Coal (100%)
- State Coal (100%)
- Private Coal
- Federal Coal Lease
- State Coal Lease
- Bypass
- Tract Boundary
- Out-of-Pit Haul Roads
- Pit Advancement

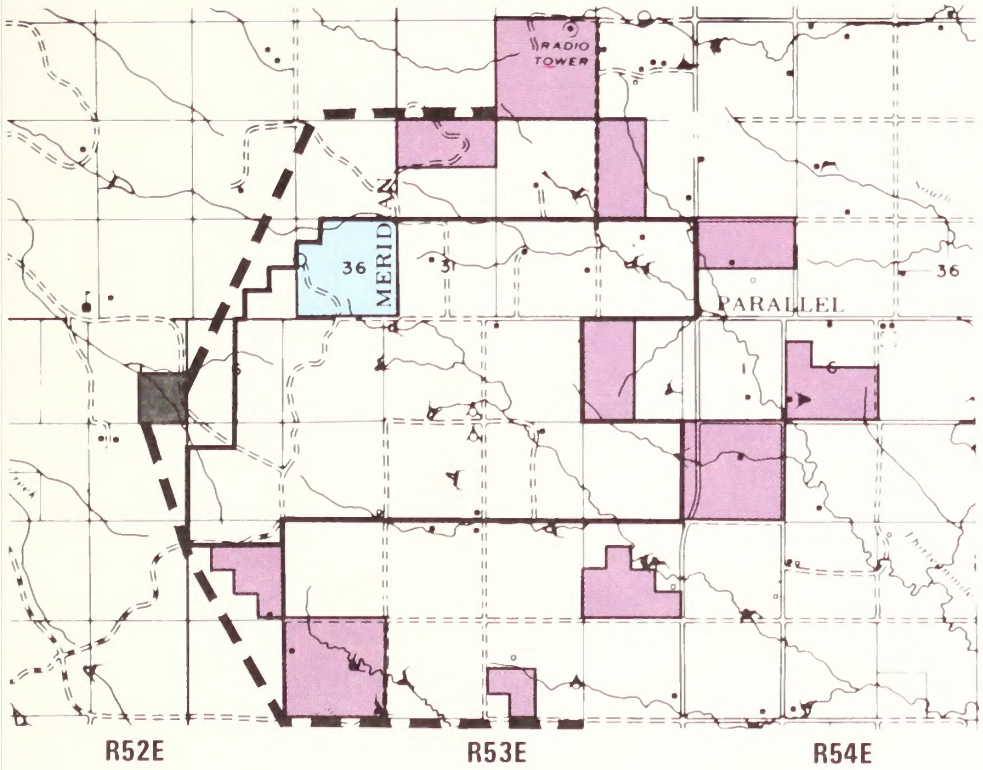
-N-

1 0 1 2 3 4 5 6

Scale In Miles

CENTRAL BLOOMFIELD TRACT

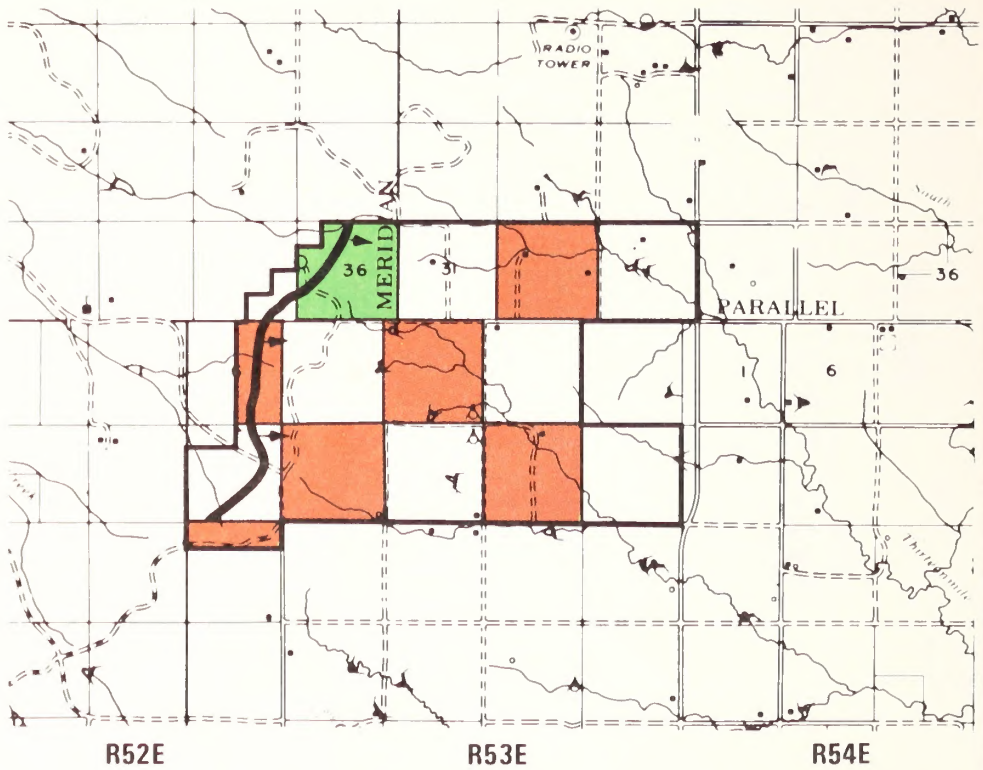
SURFACE



LEGEND

- State Surface
- Private Surface
- Surface Owner Nonconsents
- Surface Facilities
- Out-of-Pit Haul Roads
- Tract Boundary

SUBSURFACE



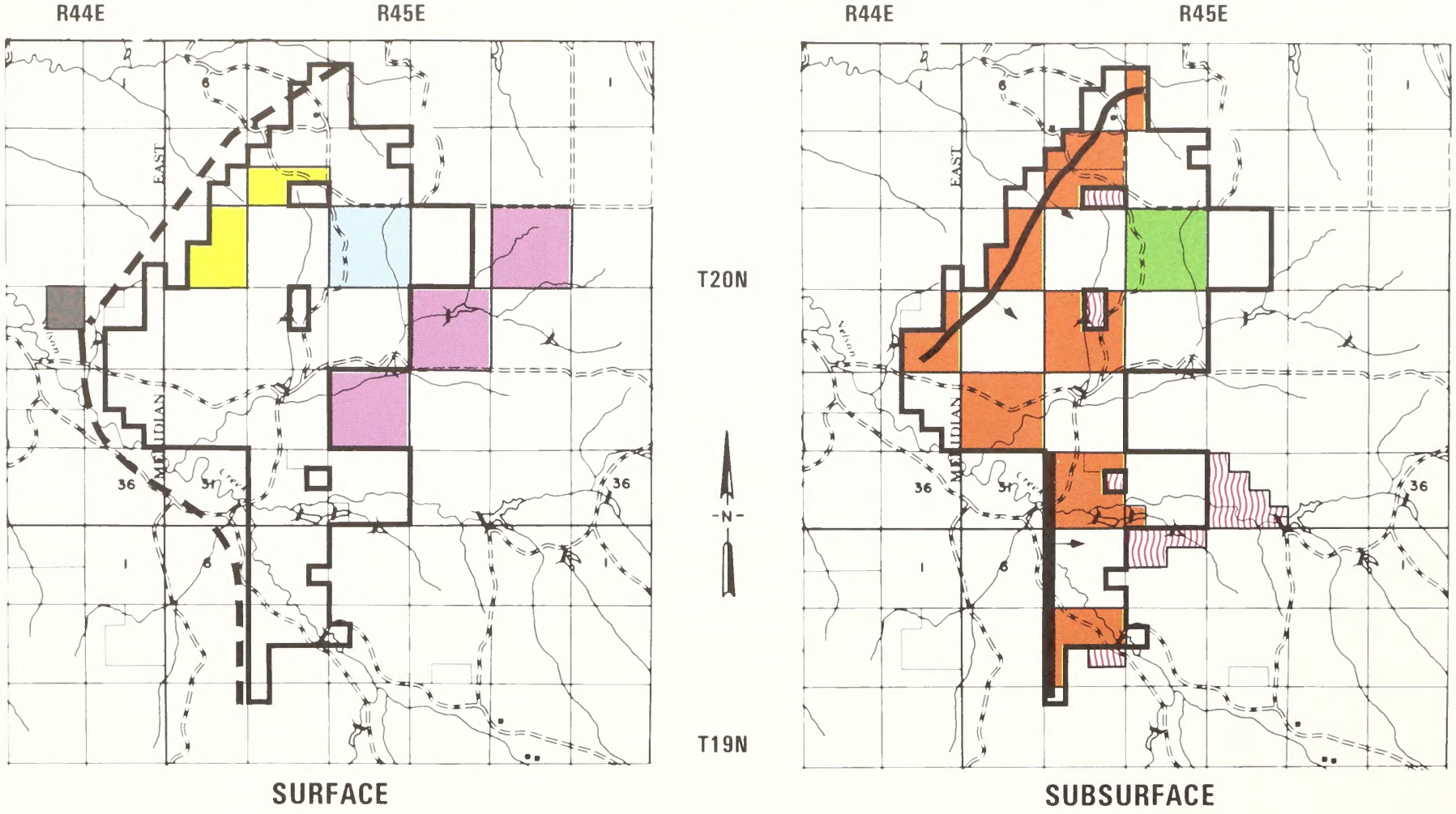
LEGEND

- Federal Coal (100%)
- State Coal (100%)
- Private Coal
- Pit Advancement
- Tract Boundary

-N-

1 0 1 2 3 4 5 6

Scale In Miles



CIRCLE WEST TRACT I

LEGEND

- Federal Surface
- State Surface
- Private Surface
- Surface Owner Nonconsents
- Surface Facilities
- Out-of-Pit Haul Roads
- Tract Boundary

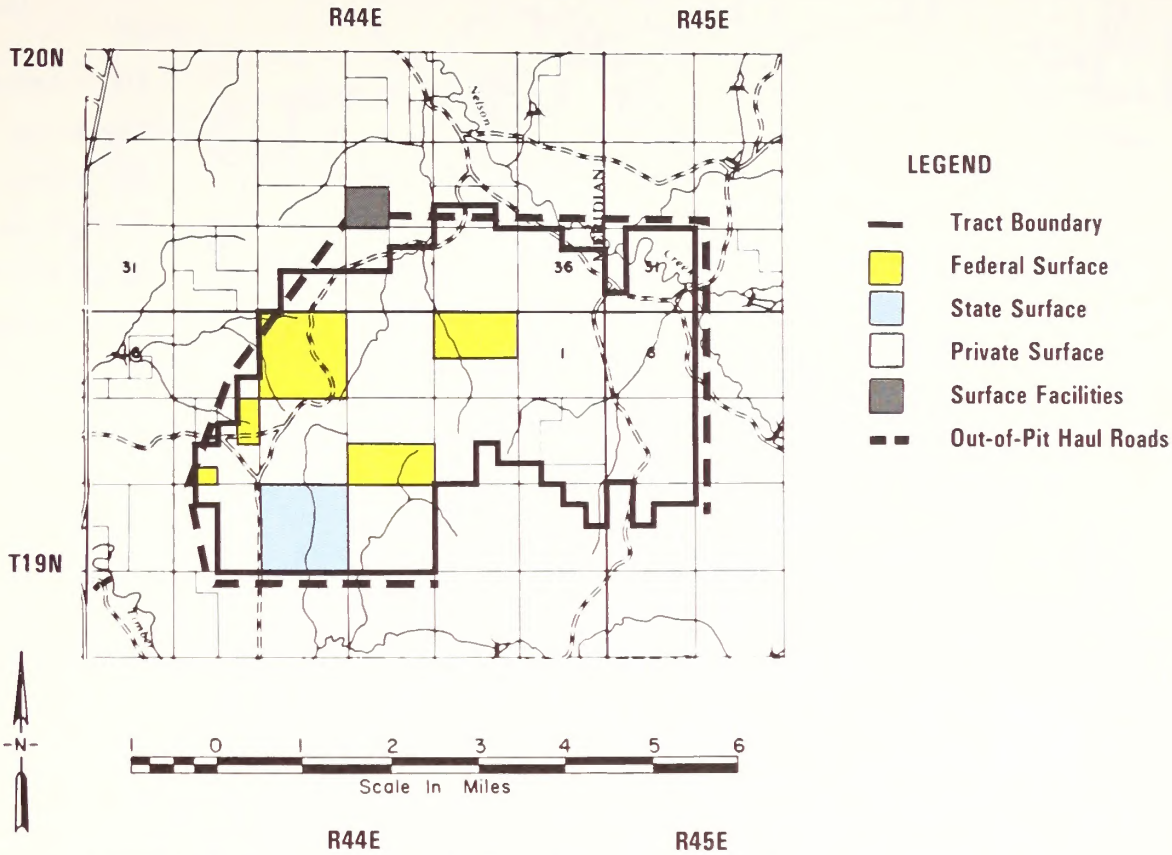
LEGEND

- Federal Coal (100%)
- State Coal (100%)
- Private Coal
- Bypasses
- Pit Advancement
- Tract Boundary

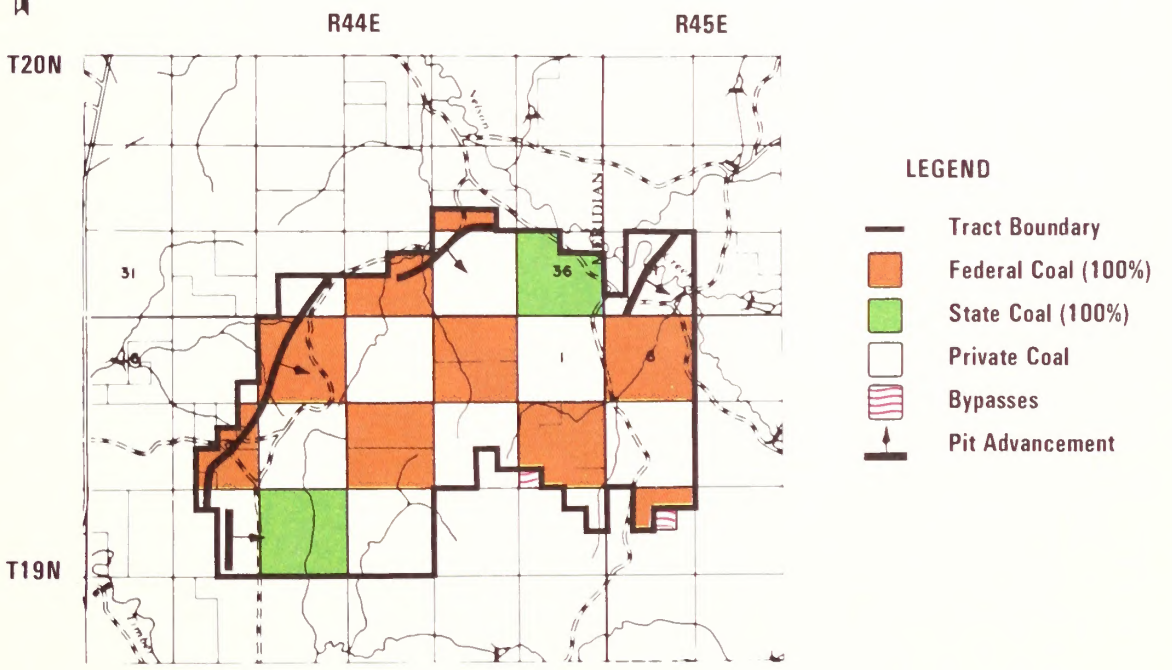
1 0 1 2 3 4 5 6

Scale In Miles

SURFACE

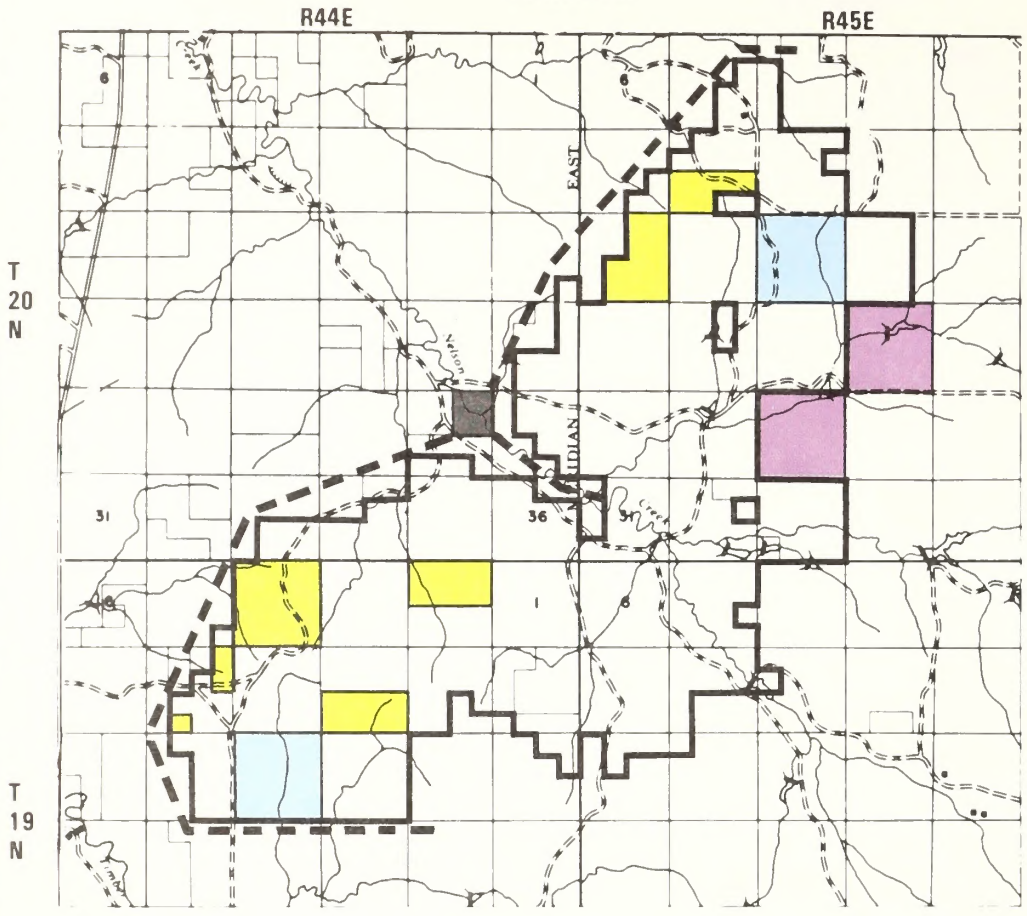


SUBSURFACE



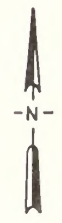
CIRCLE WEST TRACT II

SURFACE



LEGEND

- Federal Surface
- State Surface
- Private Surface
- Surface Owner Nonconsents
- Surface Facilities
- Out-of-Pit Haul Roads
- Tract Boundary



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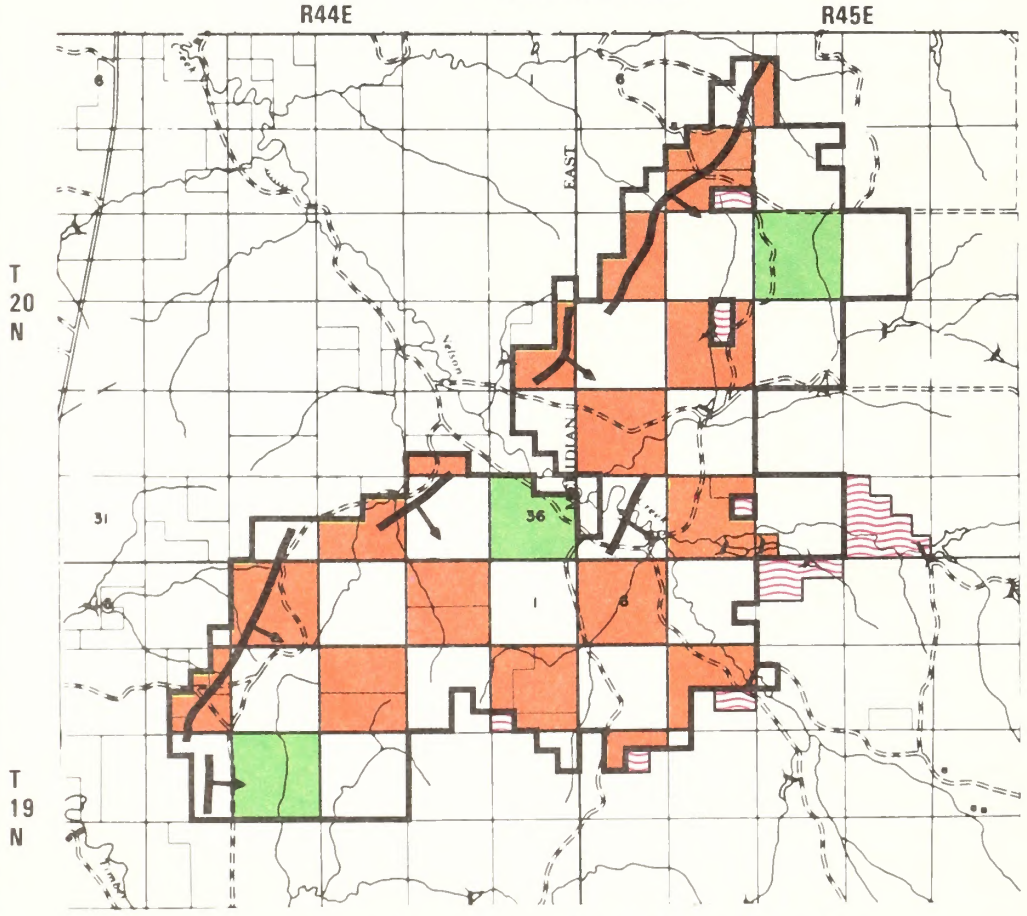
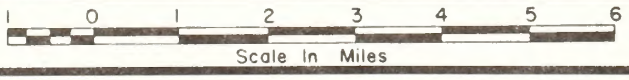
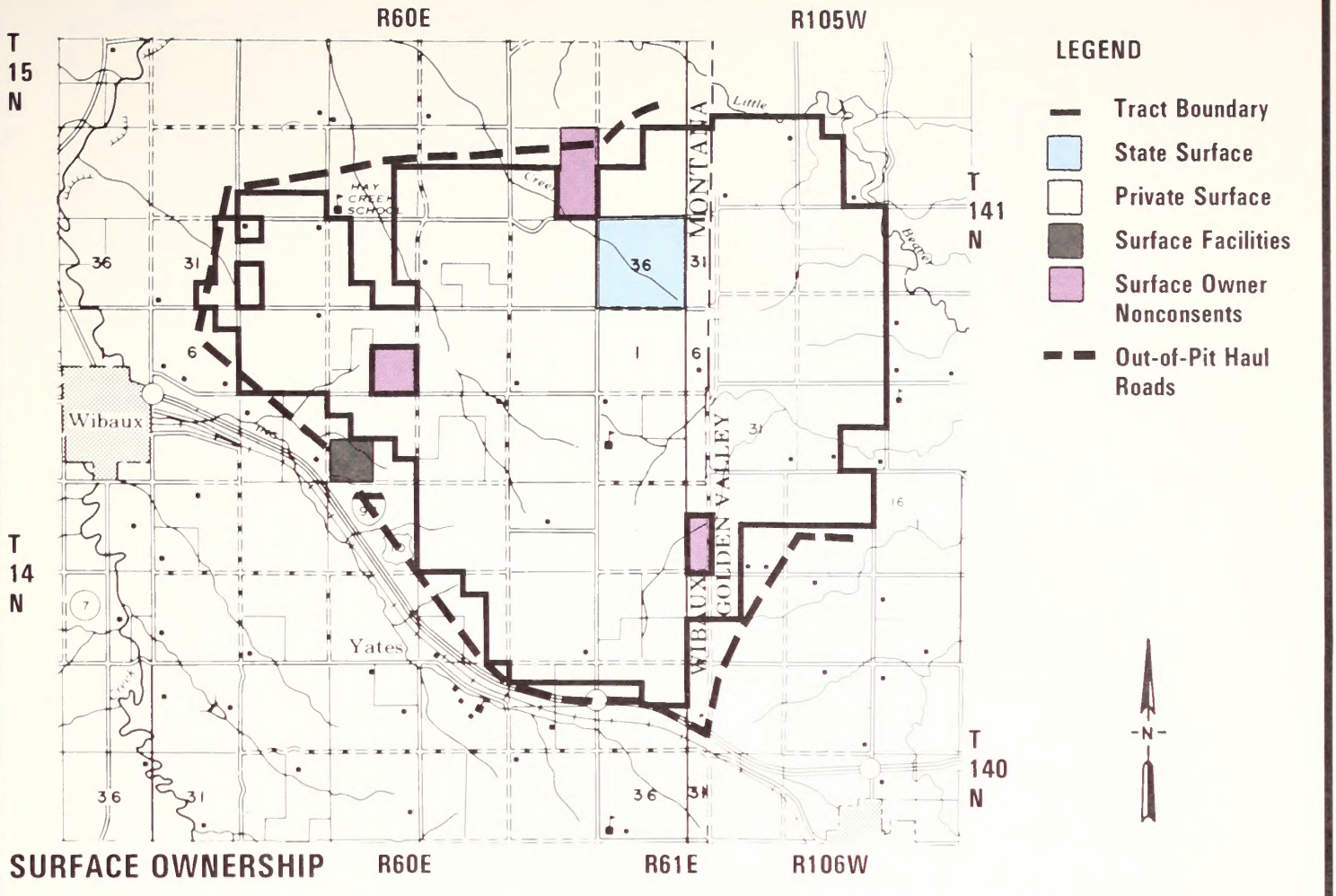


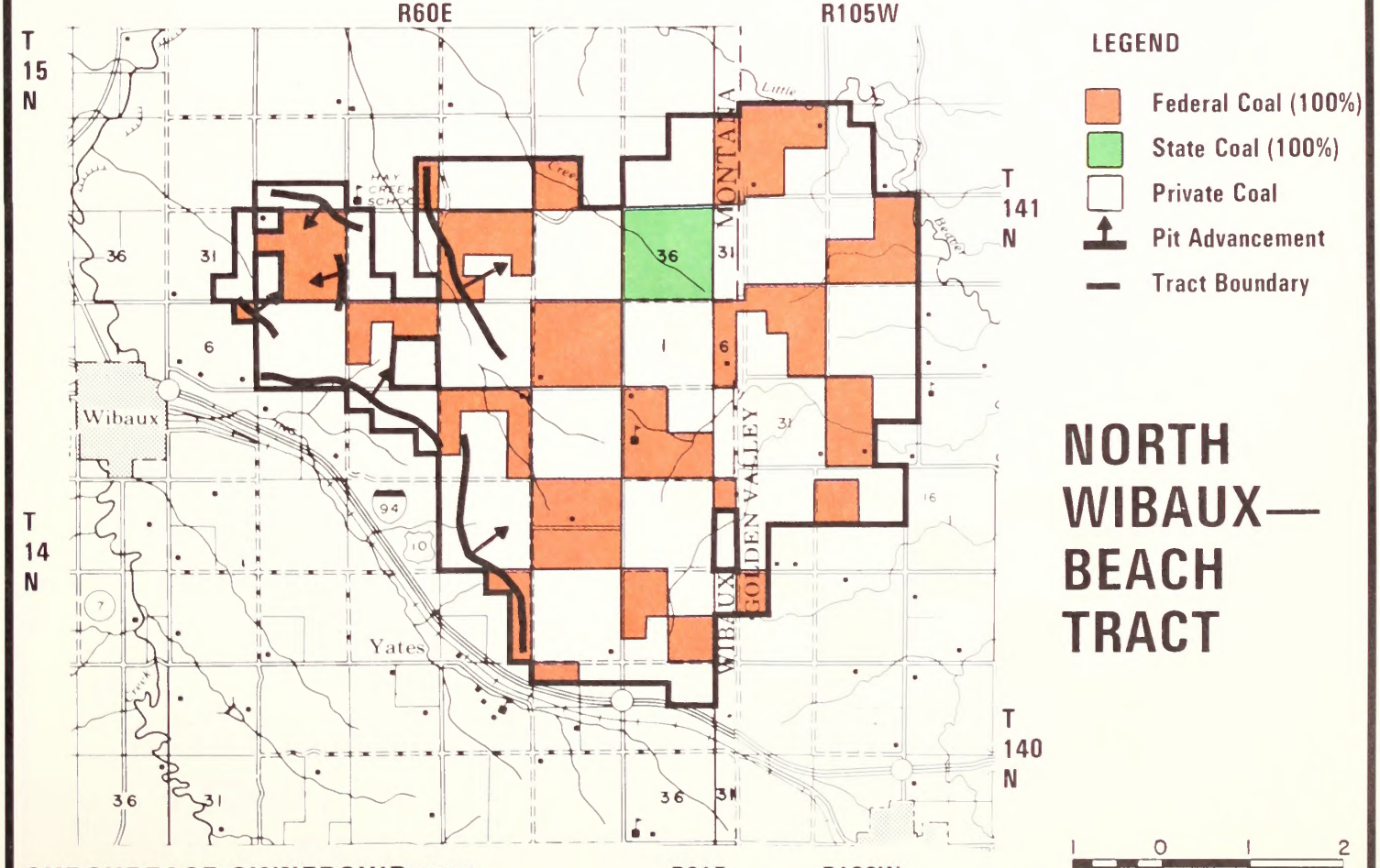
LEGEND

- Federal Coal (100%)
- State Coal (100%)
- Private Coal
- Bypasses
- Pit Advancement
- Tract Boundary



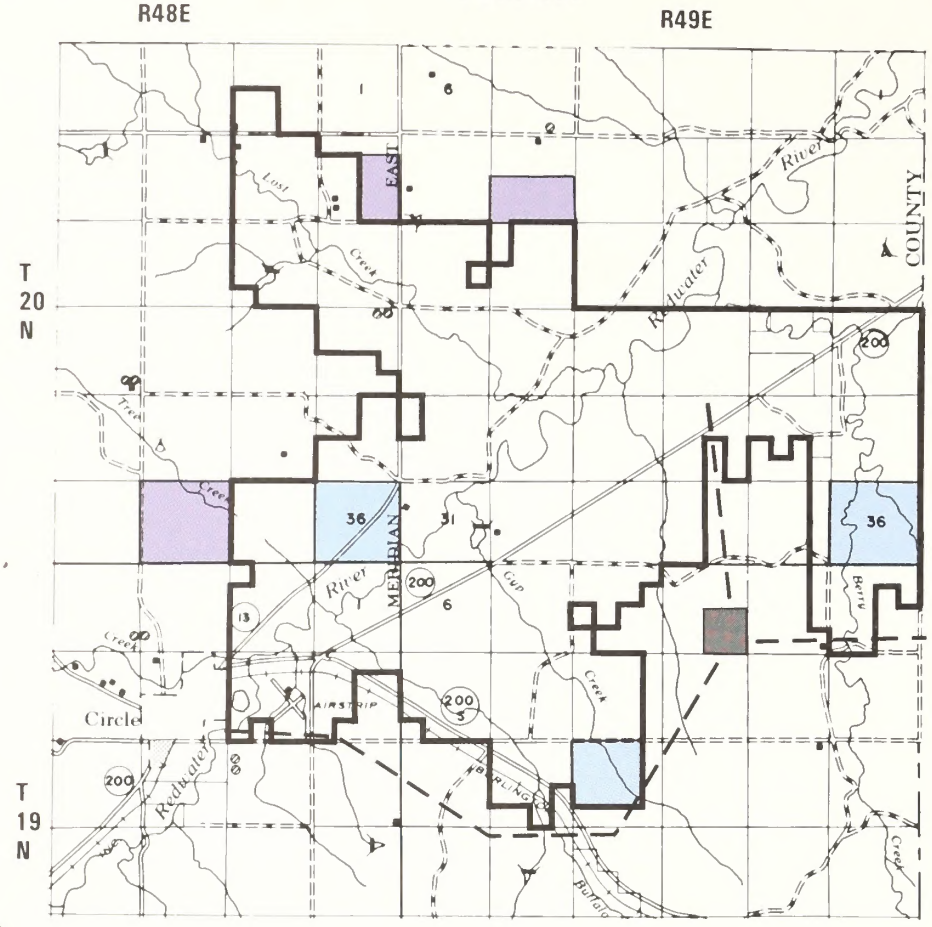
CIRCLE WEST TRACT III





NORTH WIBAUX—BEACH TRACT

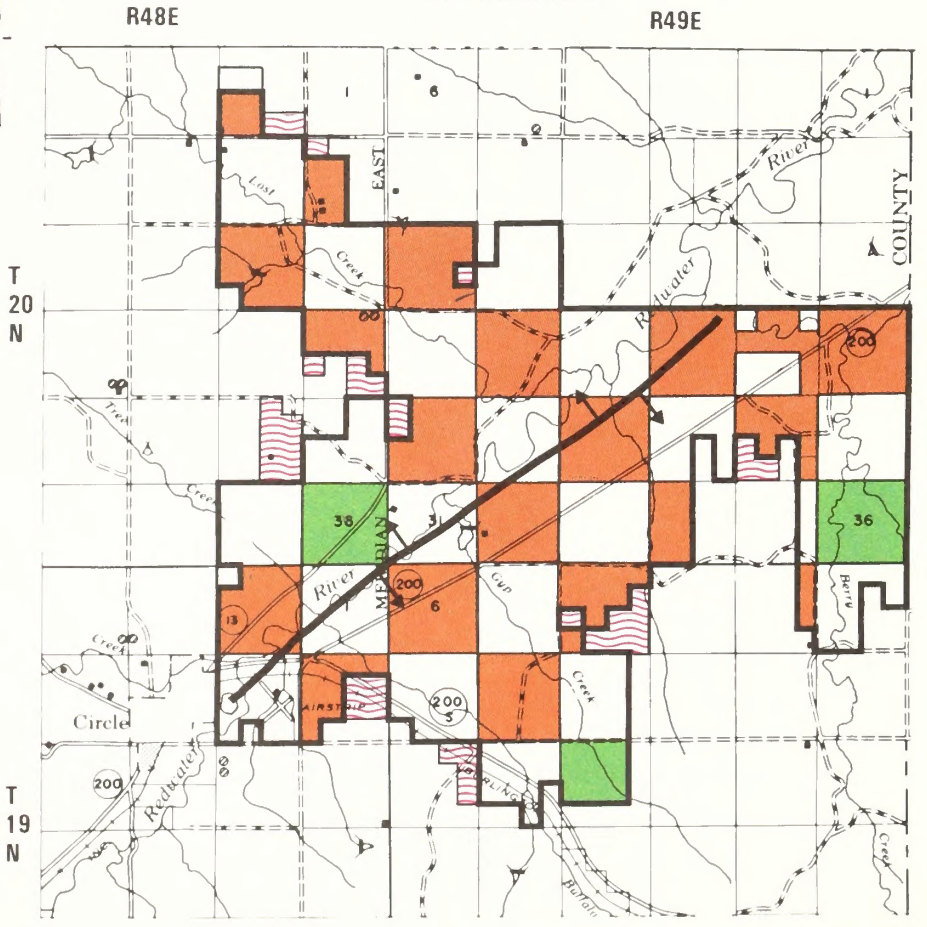
SURFACE



LEGEND

- State Surface
- Private Surface
- Surface Owner Nonconsents
- Surface Facilities
- Out-of-Pit Haul Roads
- Tract Boundary

SUBSURFACE

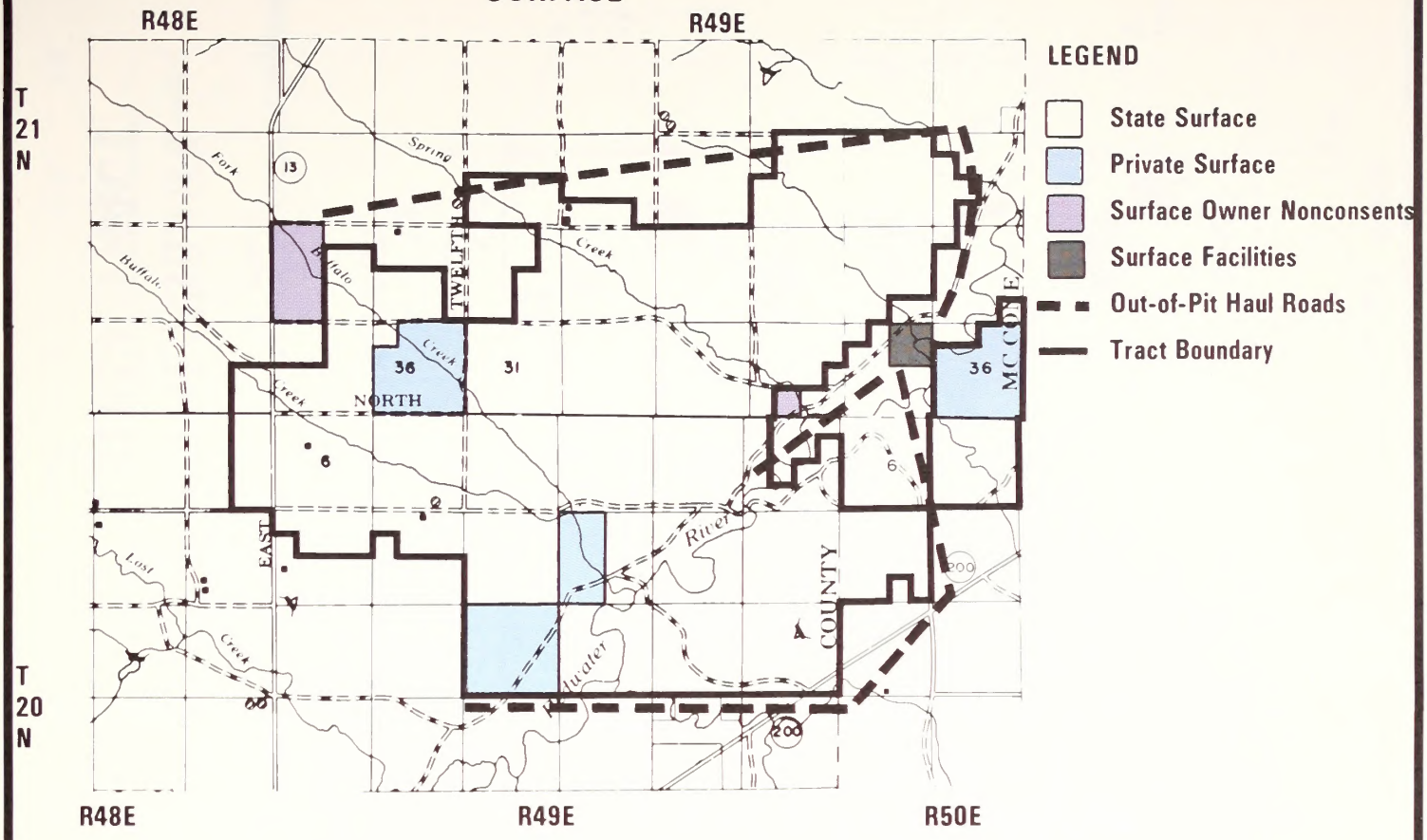


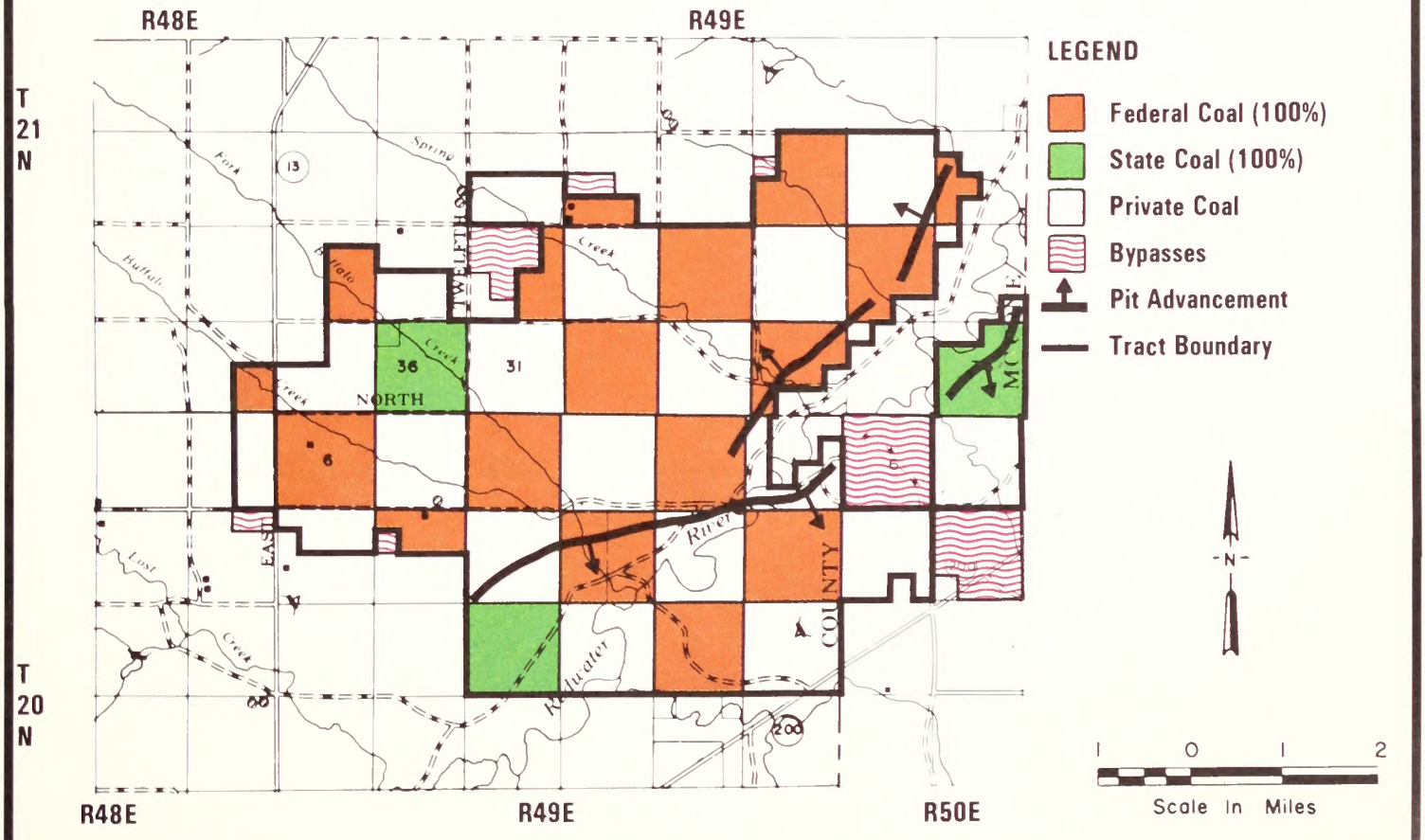
LEGEND

- Federal Coal (100%)
- State Coal (100%)
- Private Coal
- Bypasses
- Pit Advancement
- Tract Boundary

REDWATER TRACT I

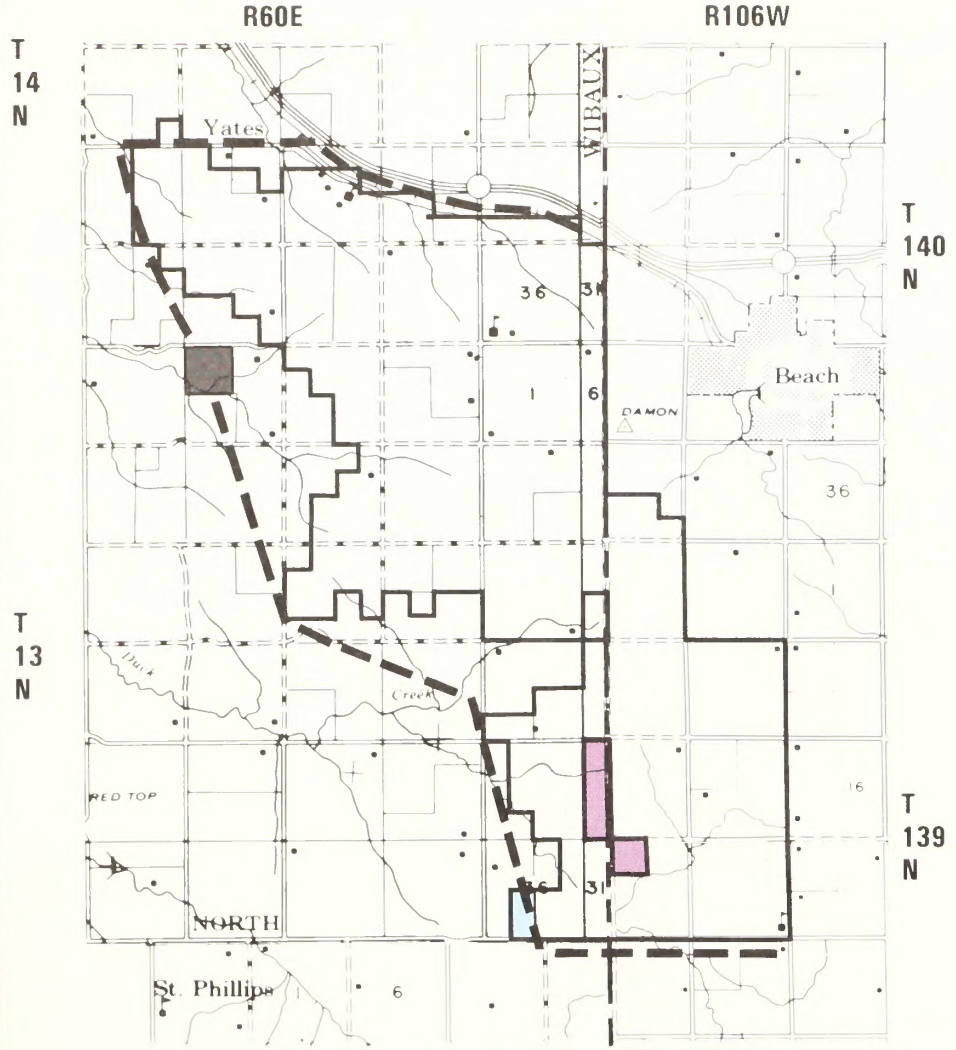
SURFACE



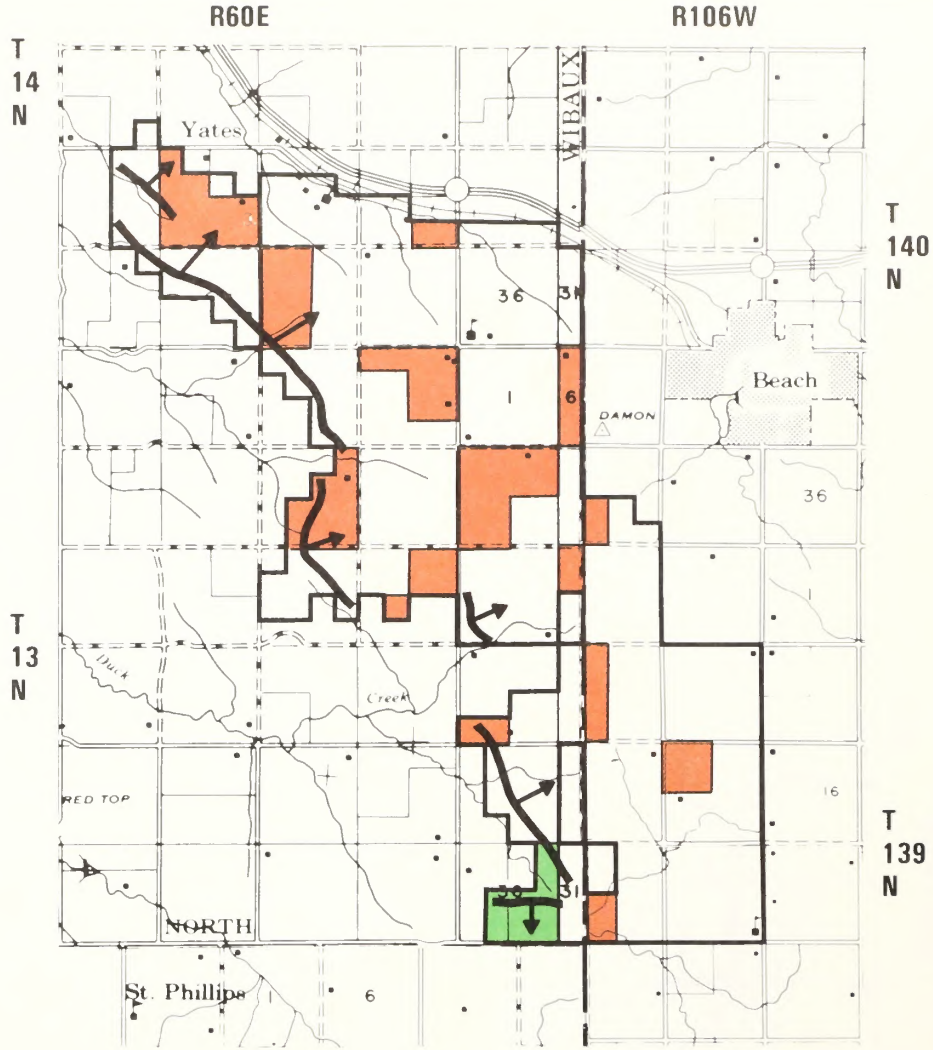


SUBSURFACE

REDWATER TRACT II



SURFACE OWNERSHIP



SUBSURFACE OWNERSHIP

LEGEND

- State Surface
- Private Surface
- Surface Owner Nonconsents
- Tract Boundary
- Surface Facilities
- Out-of-Pit Haul Roads
- Federal Coal (100%)
- State Coal (100%)
- Private Coal
- Pit Advancement

1 0 1 2 3 4 5 6

Scale In Miles

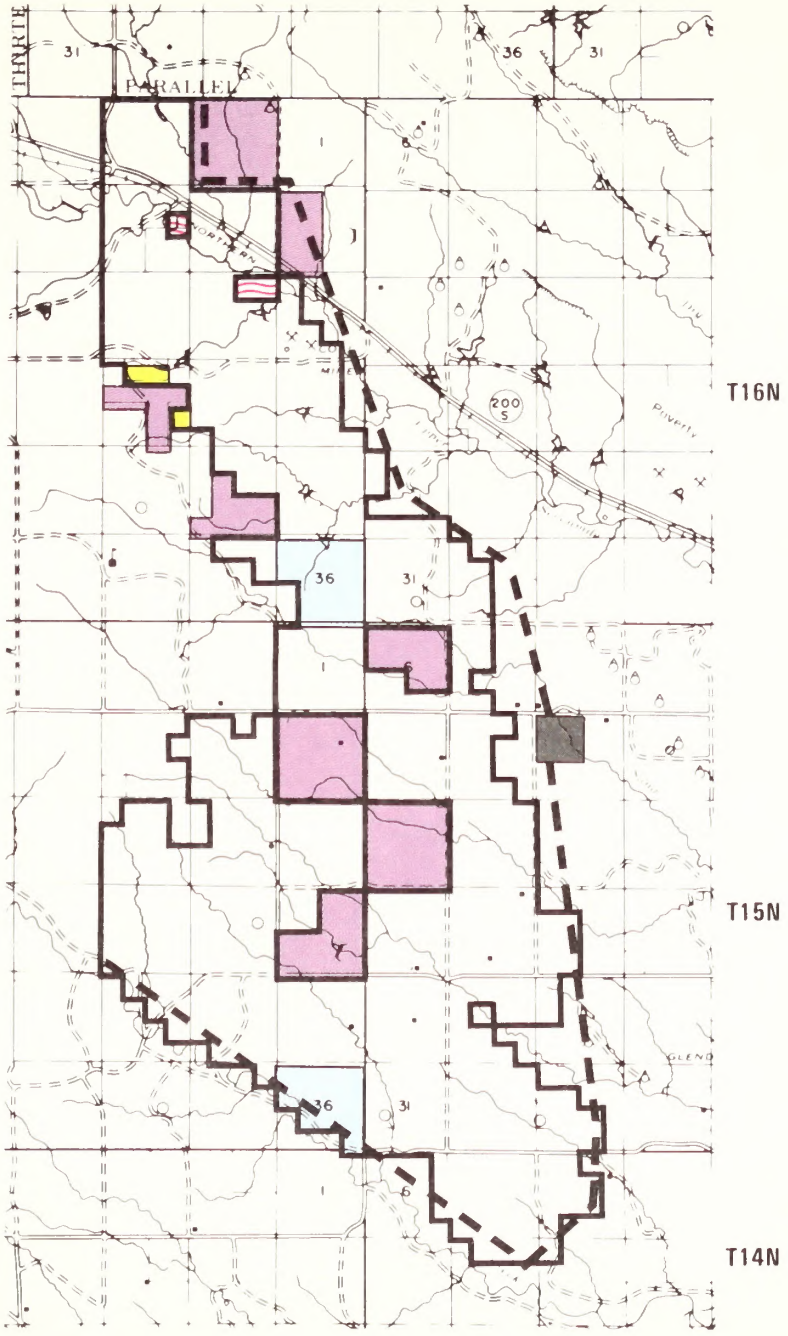
SOUTH WIBAUX—BEACH TRACT

SOUTHWEST GLENDIVE TRACT

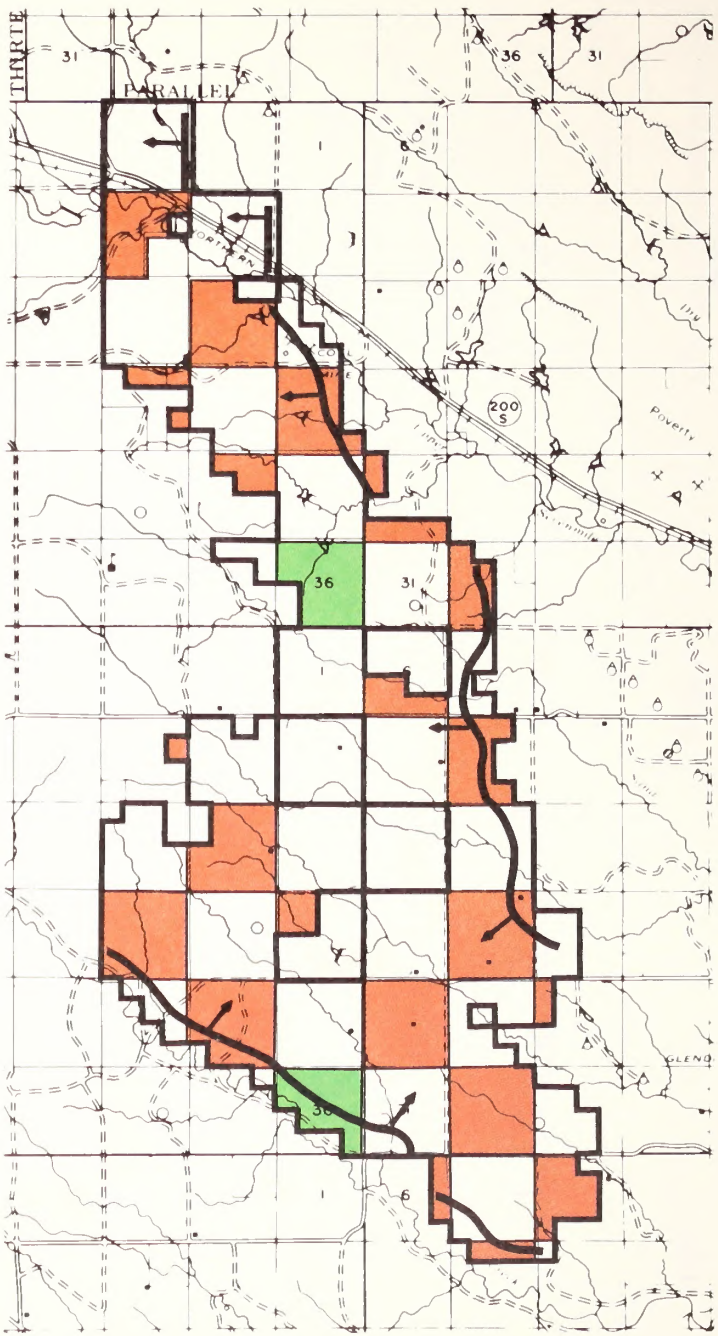
LEGEND

- Federal Surface
- State Surface
- Private Surface
- Surface Owner Nonconsents
- Tract Boundary
- Federal Coal (100%)
- State Coal (100%)
- Private Coal
- Bypasses
- Surface Facilities
- Out-of-Pit Haul Roads
- Pit Advancement

0 1 2 3 4 5
Scale In Miles



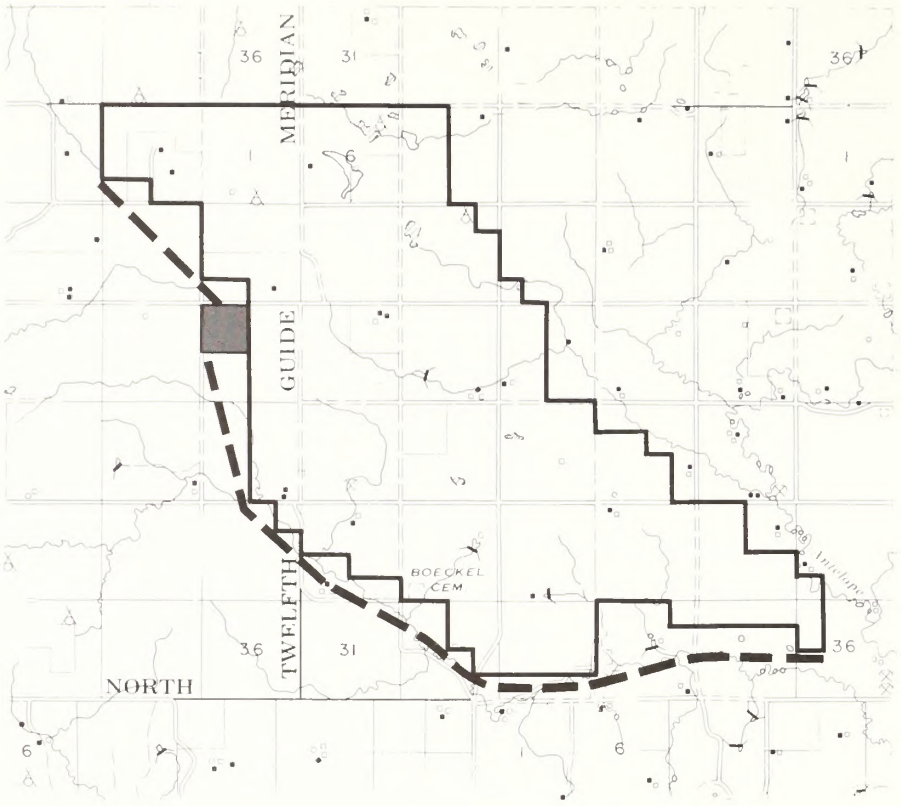
SURFACE



SUBSURFACE

R88W R87W

T145N



LEGEND

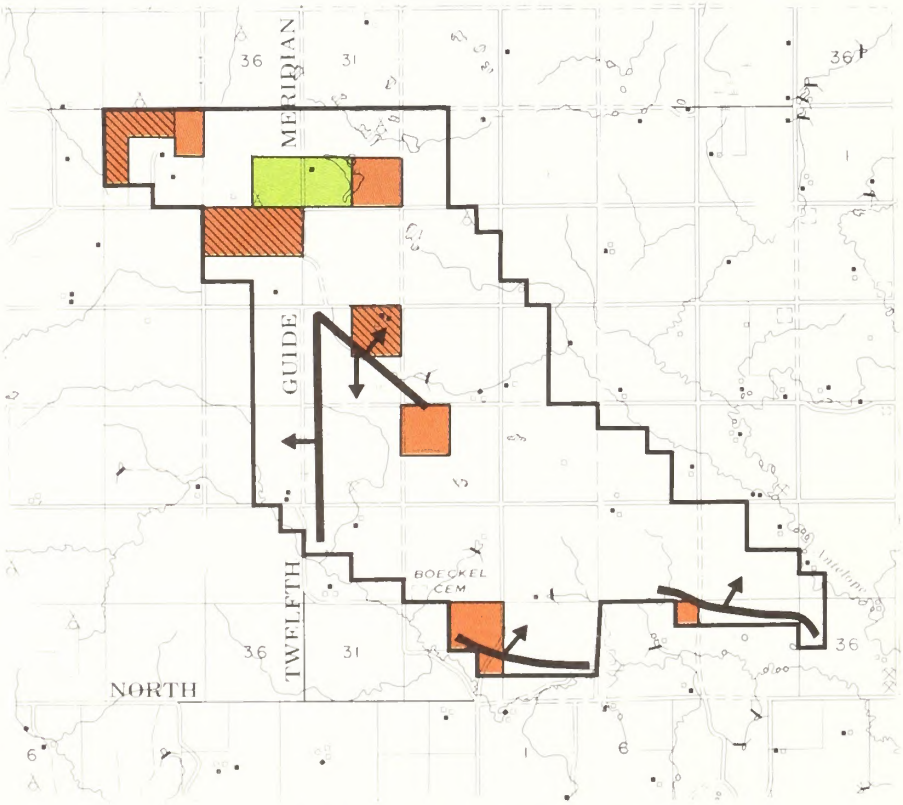
- Private Surface
- Tract Boundary
- Surface Facilities
- Out-of-Pit Haul Roads

SURFACE OWNERSHIP

ANTELOPE TRACT

R88W R87W

T145N



LEGEND

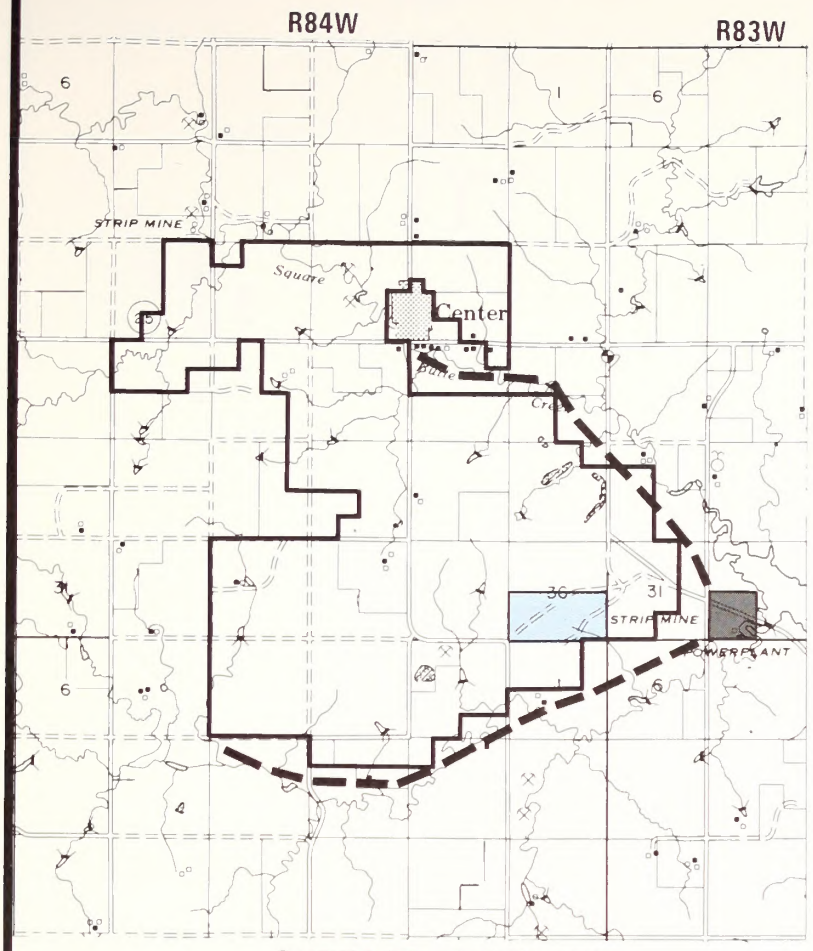
- Federal Coal (100%)
- State Coal (Less than 100%)
- Private Coal
- Federal Coal Lease
- Pit Advancement
- Tract Boundary

SUBSURFACE OWNERSHIP

0 1 2 3 4 5 6

Scale In Miles

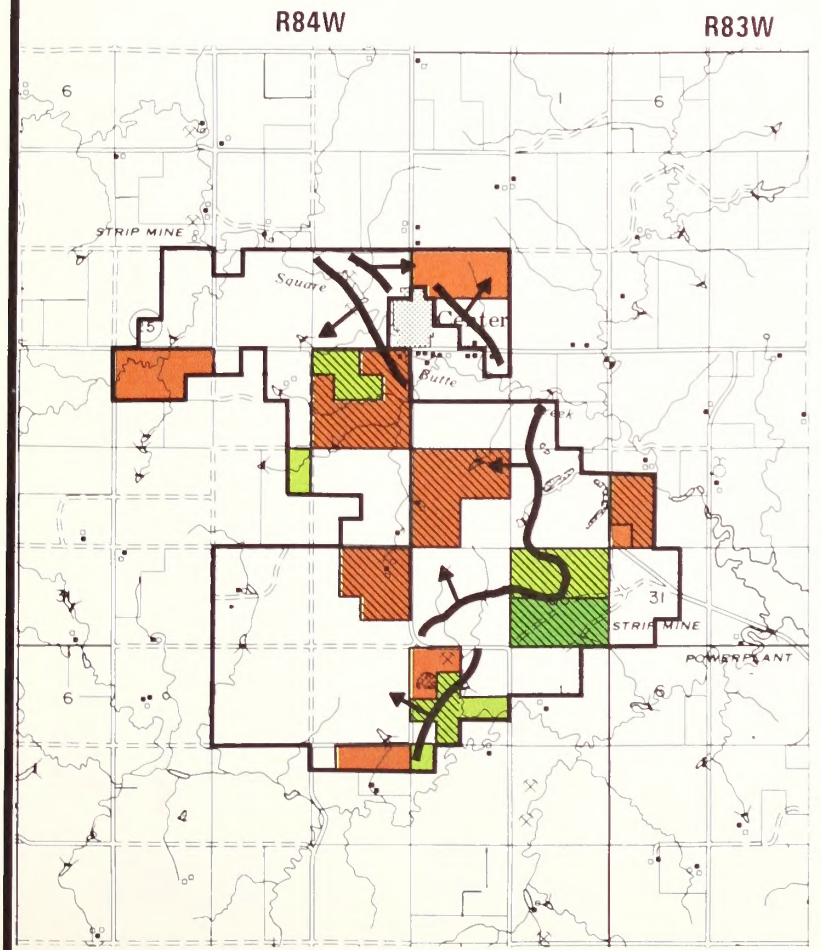
CENTER TRACT



SURFACE OWNERSHIP

LEGEND

- State Surface
- Private Surface
- Surface Facilities
- Out-of-Pit Haul Roads
- Tract Boundary



SUBSURFACE OWNERSHIP

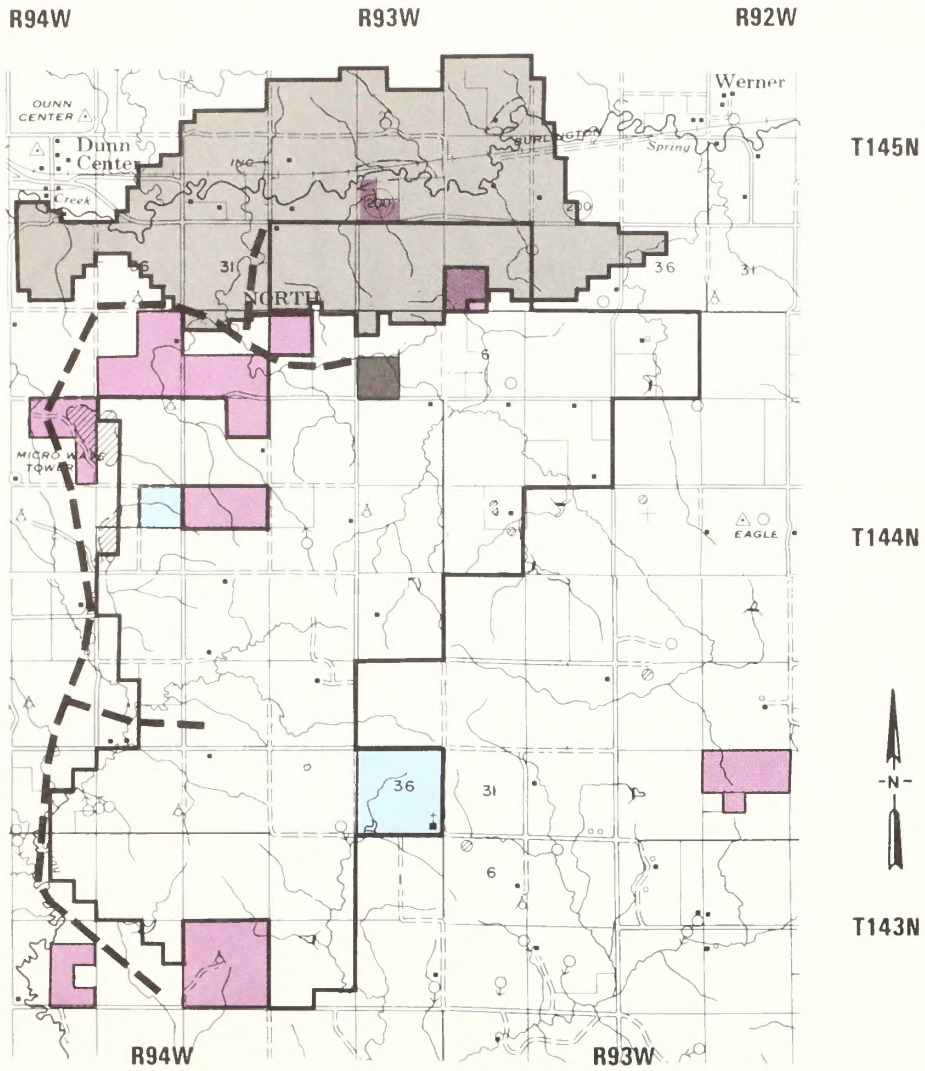
LEGEND

- Federal Coal (100%)
- State Coal (Less than 100%)
- State Coal (100%)
- Private Coal
- Coal Lease
- Pit Advancement
- Tract Boundary

0 1 2 3 4 5 6

Scale In Miles

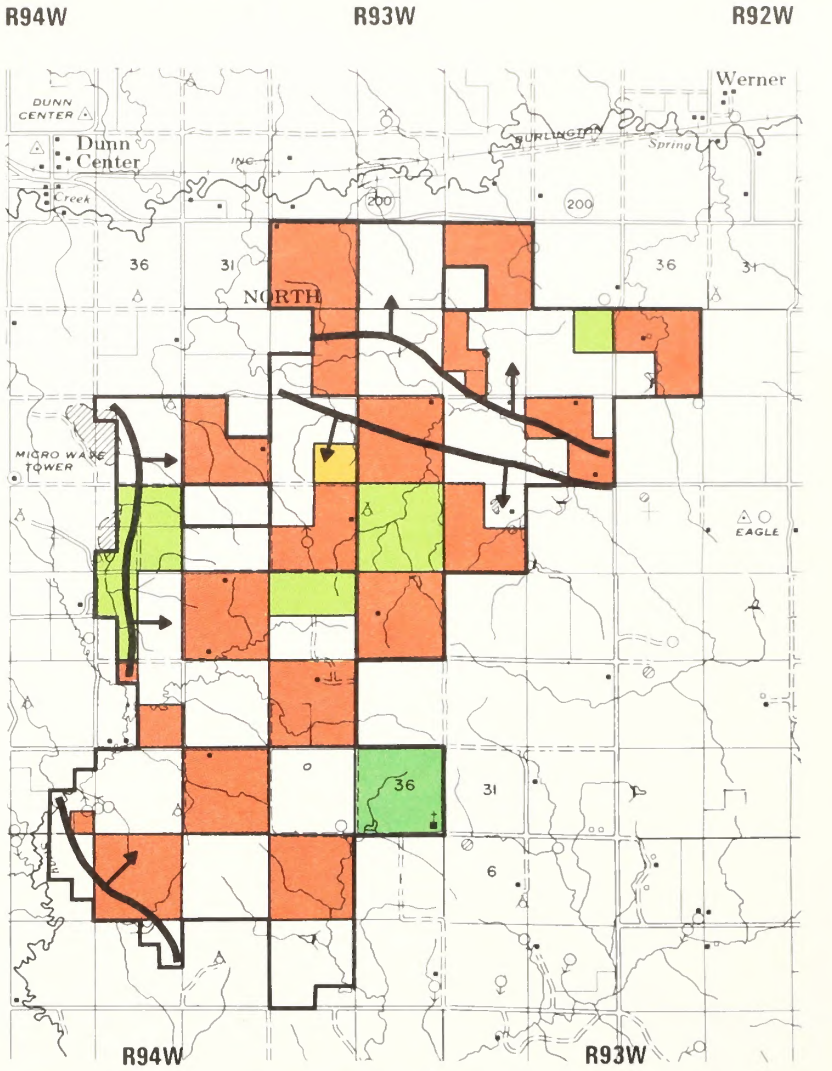
DUNN CENTER S.E. TRACT



SURFACE OWNERSHIP

LEGEND

- State Surface
- Private Surface
- Surface Owner Nonconsents
- Knife River Flint Quarry National Register District (Declared Eligible for National Register
- Surface Facilities
- Out-of-Pit Haul Roads
- Tract Boundary

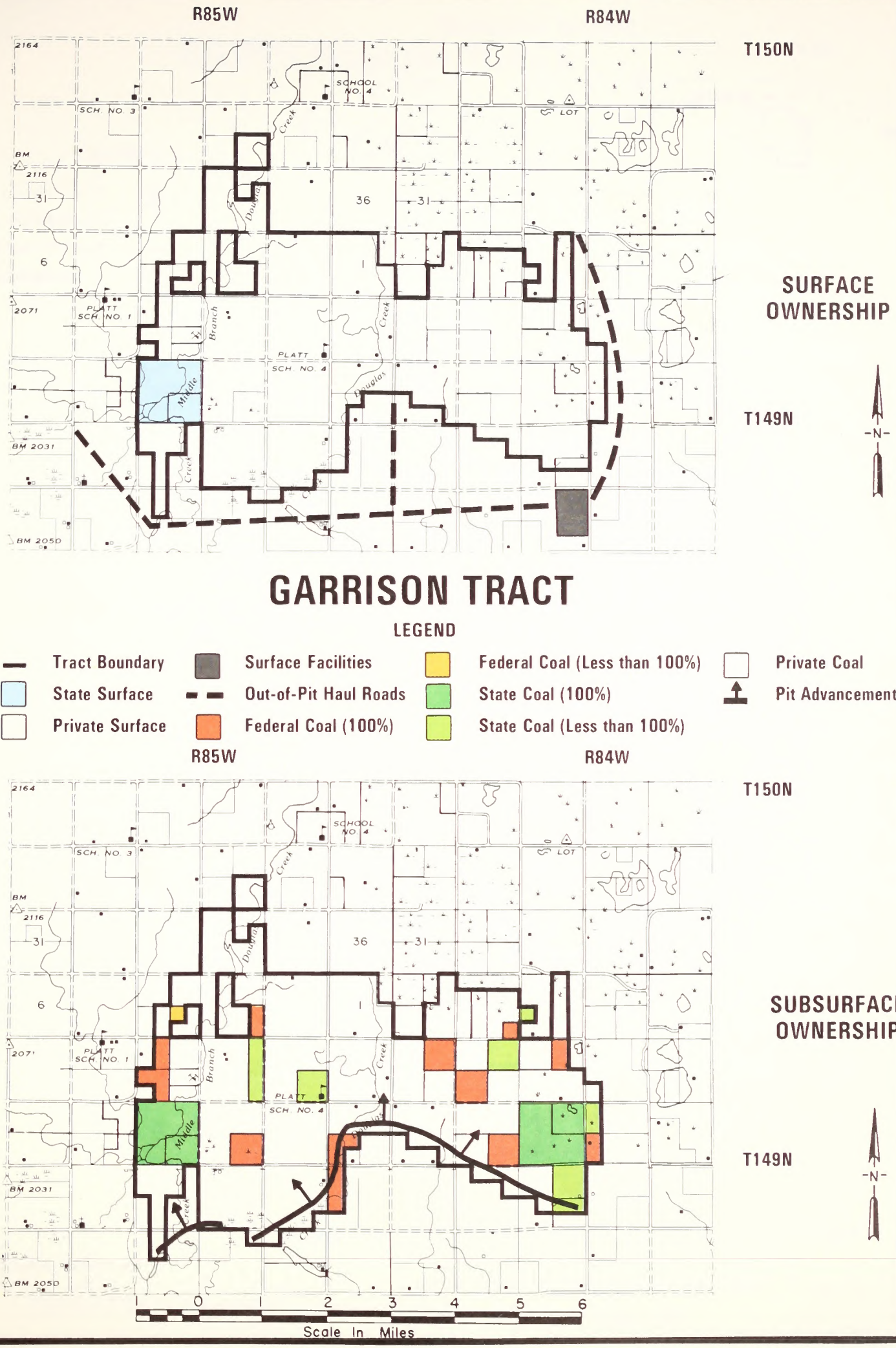


SUBSURFACE OWNERSHIP

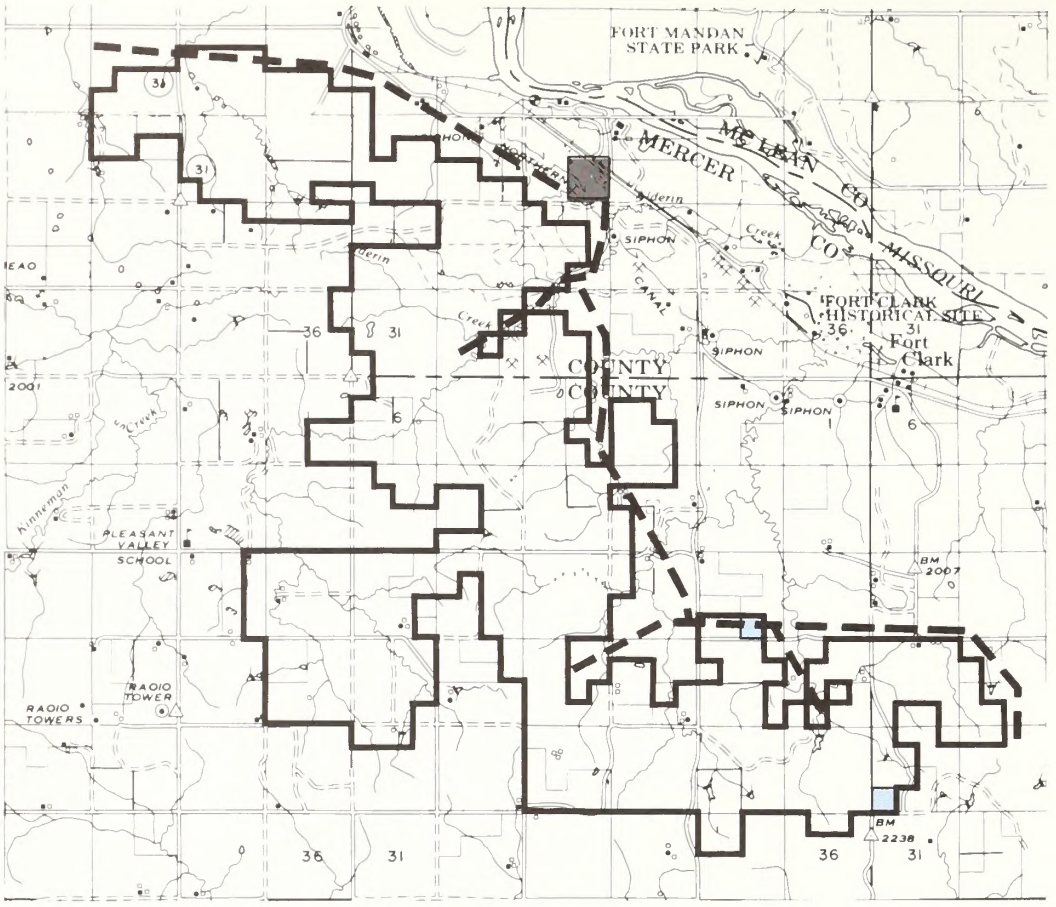
LEGEND

- Federal Coal (100%)
- Federal Coal (Less than 100%)
- State Coal (100%)
- State Coal (Less than 100%)
- Private Coal
- Pit Advancement
- Tract Boundary

0 1 2 3 4 5 6


R85W
R84W
T150N
T149N
SURFACE OWNERSHIP
SCHOOL NO. 4
SCH. NO. 3
LOT
BM 2116
2164
31
36
6
1
2071
PLATT SCH. NO. 1
PLATT SCH. NO. 4
Middle Fk Branch
Douglas Creek
BM 2031
BM 2050
N
GARRISON TRACT
LEGEND
Tract Boundary
State Surface
Private Surface
Surface Facilities
Out-of-Pit Haul Roads
Federal Coal (100%)
Federal Coal (Less than 100%)
State Coal (100%)
State Coal (Less than 100%)
Private Coal
Pit Advancement
SUBSURFACE OWNERSHIP
0 1 2 3 4 5 6
Scale In Miles

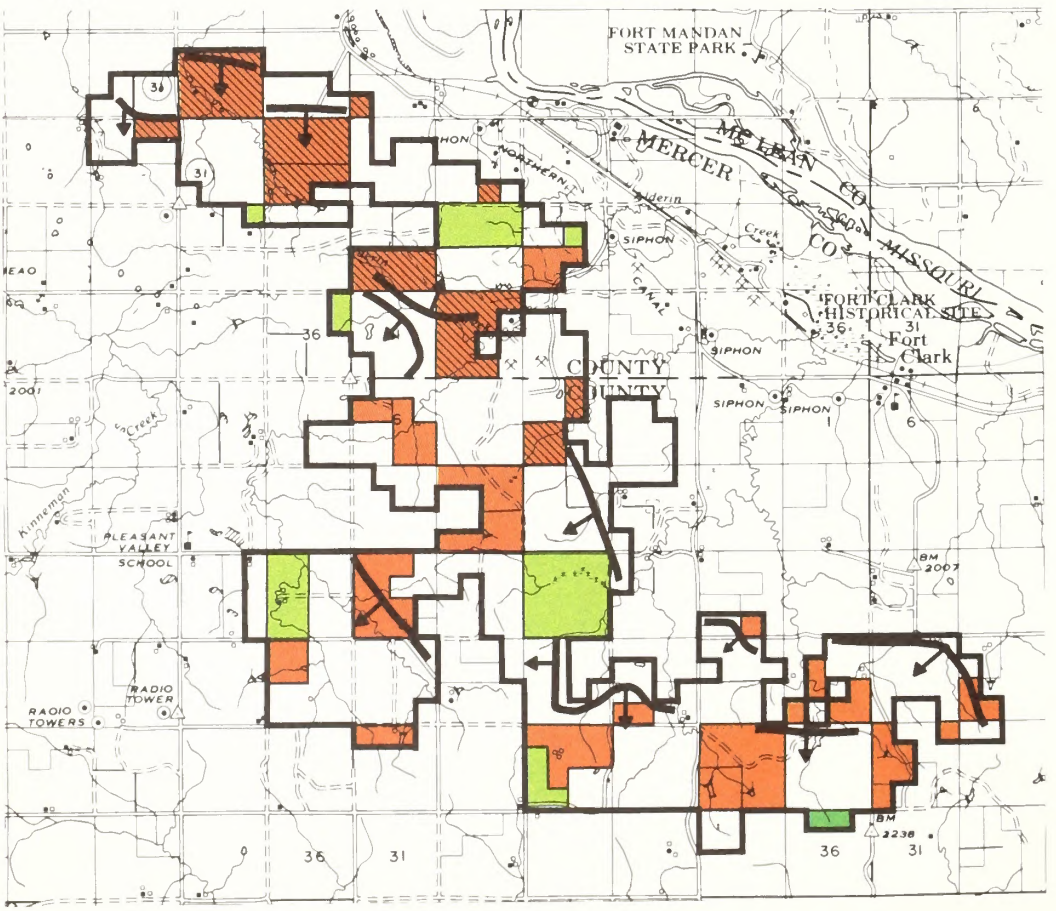
SURFACE OWNERSHIP



LEGEND

- State Surface
- Private Surface
- Out-of-Pit Haul Roads
- Surface Facilities
- Tract Boundary

SUBSURFACE OWNERSHIP



LEGEND

- Federal Coal (100%)
- Federal Coal Lease
- State Coal (100%)
- State Coal (Less than 100%)
- Pit Advancement
- Tract Boundary

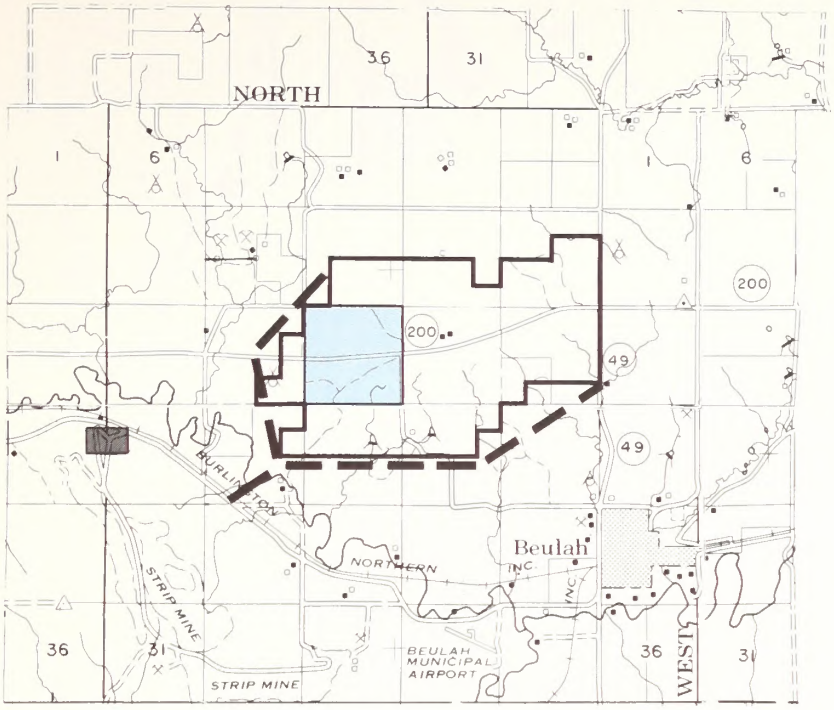
-N-

1 0 1 2

Scale In Miles

GLENHAROLD TRACT

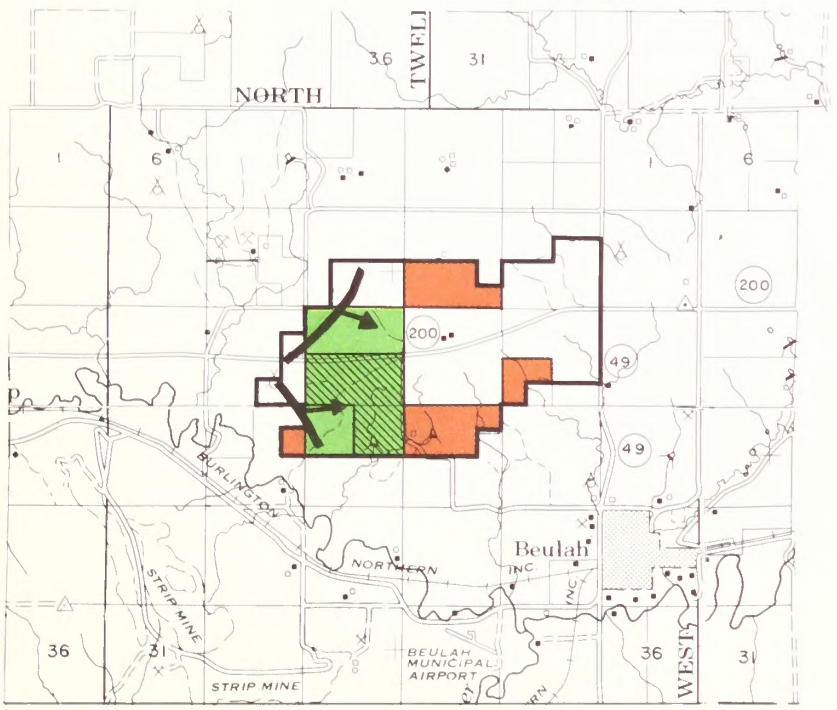
NORTH BEULAH TRACT



SURFACE OWNERSHIP

LEGEND

- State Surface
- Private Surface
- Surface Facilities
- Out-of-Pit Haul Roads
- Tract Boundary



SUBSURFACE OWNERSHIP

LEGEND

- Federal Coal (100%)
- State Coal (100%)
- Private Coal
- Leased State Coal
- Pit Advancement
- Tract Boundary

-N-

1 0 1 2 3 4 5 6

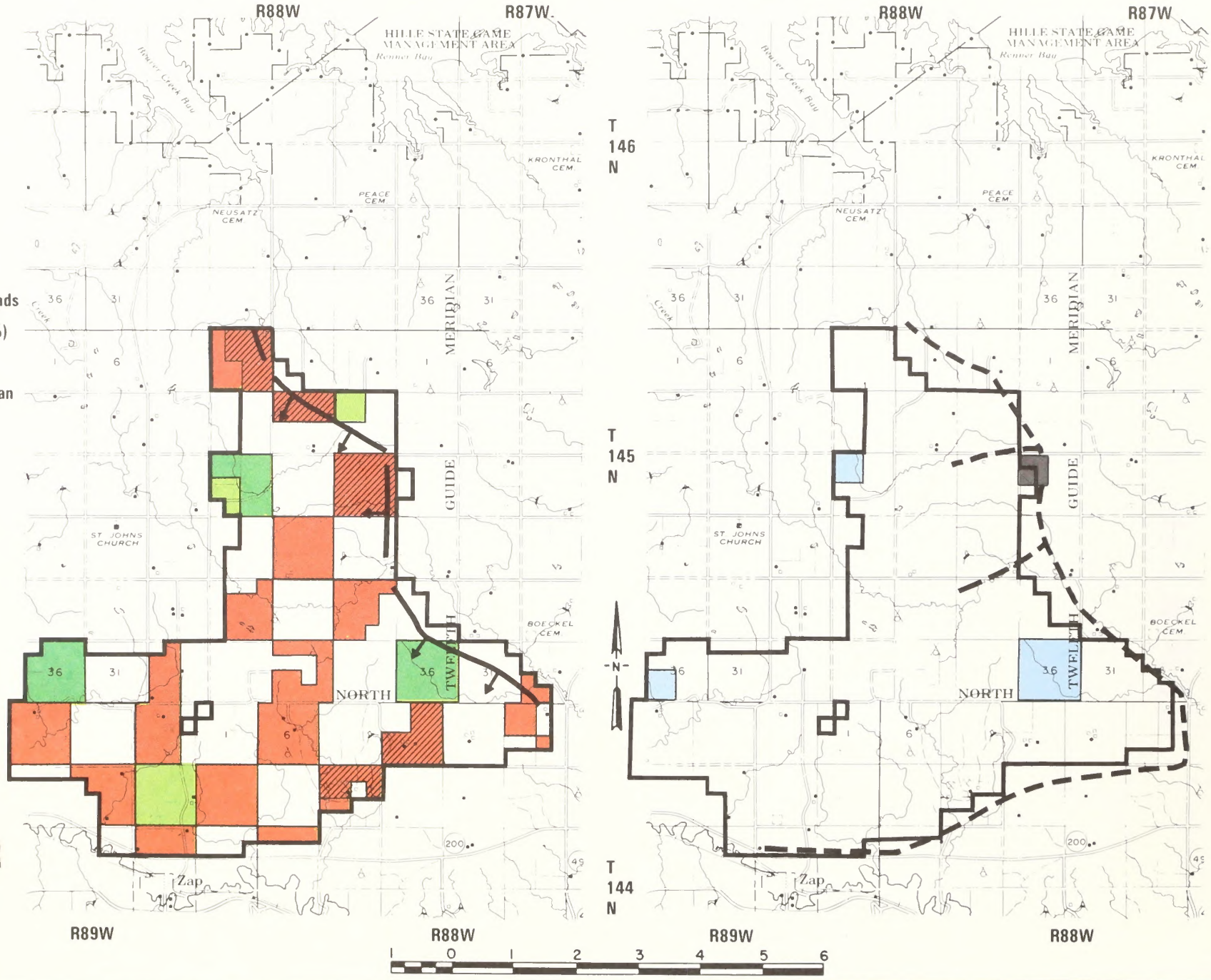
Scale In Miles

SUBSURFACE OWNERSHIP

SURFACE OWNERSHIP

LEGEND

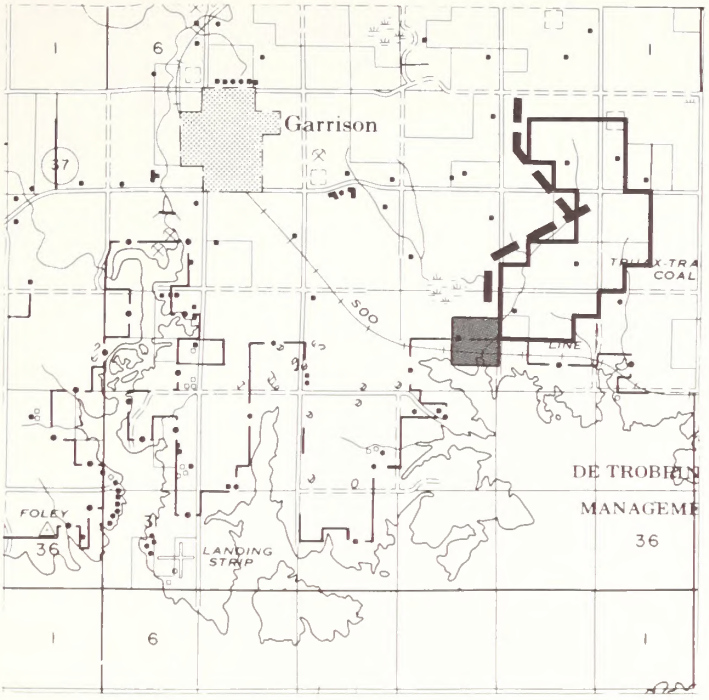
- State Surface
- Private Surface
- Surface Facilities
- Out-of-Pit Haul Roads
- Federal Coal (100%)
- State Coal (100%)
- State Coal (Less than 100%)
- Private Coal
- Coal Lease
- Pit Advancement
- Tract Boundary



RENNER TRACT

R84W

T148



SURFACE

LEGEND

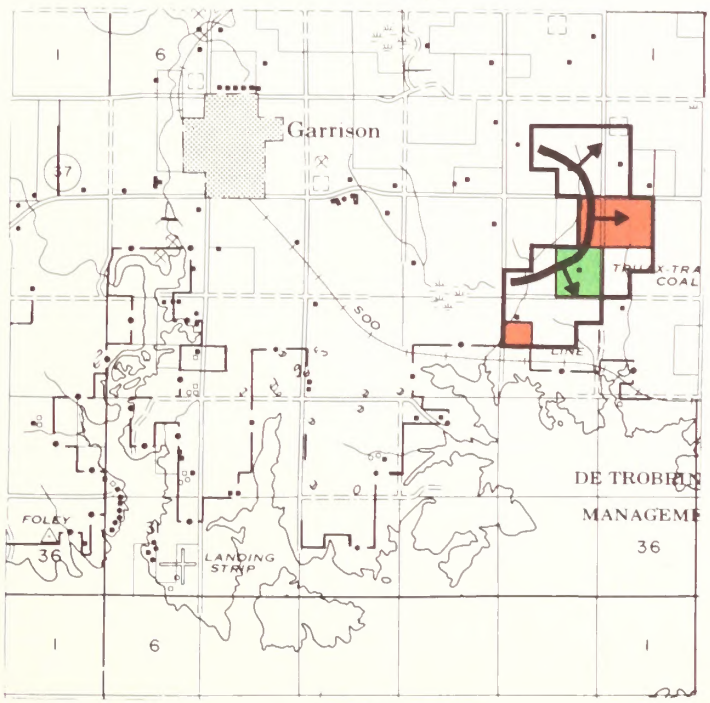
- Private Surface
- Surface Facilities
- Out-of-Pit Haul Roads
- Tract Boundary

-N-

SAKAKAWEA TRACT

R84W

T148N



SUBSURFACE

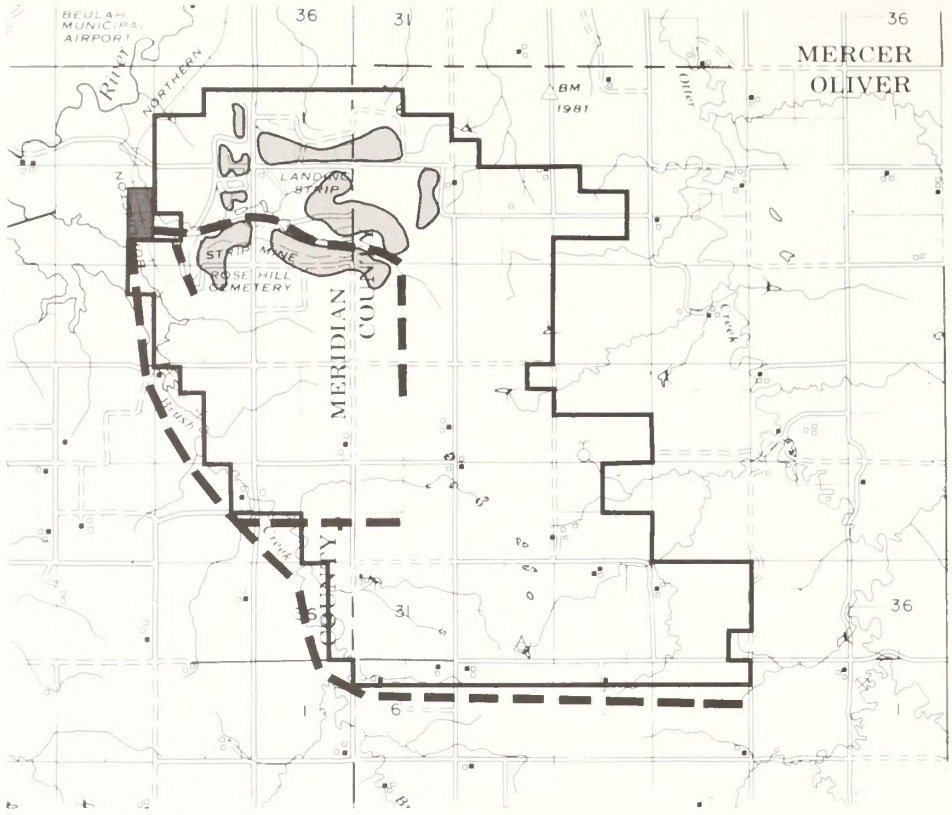
LEGEND

- Federal Coal (100%)
- State Coal (100%)
- Private Coal
- Pit Advancement
- Tract Boundary

1 0 1 2 3 4 5 6

Scale In Miles

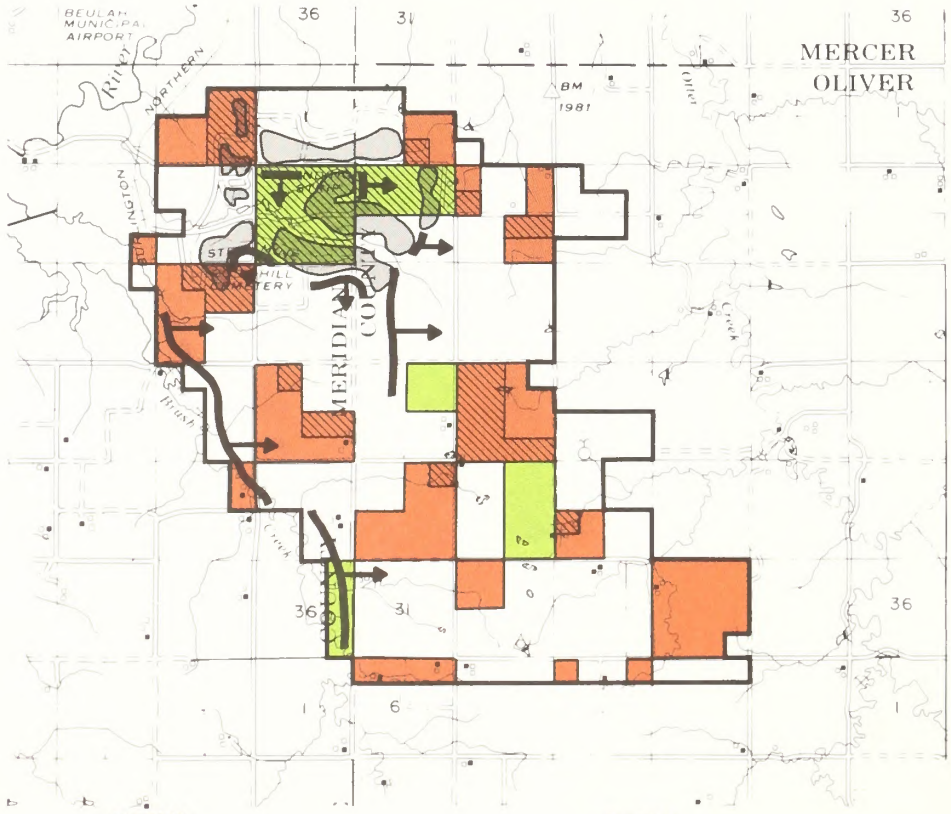
SCHOOLHOUSE TRACT



SURFACE OWNERSHIP

LEGEND

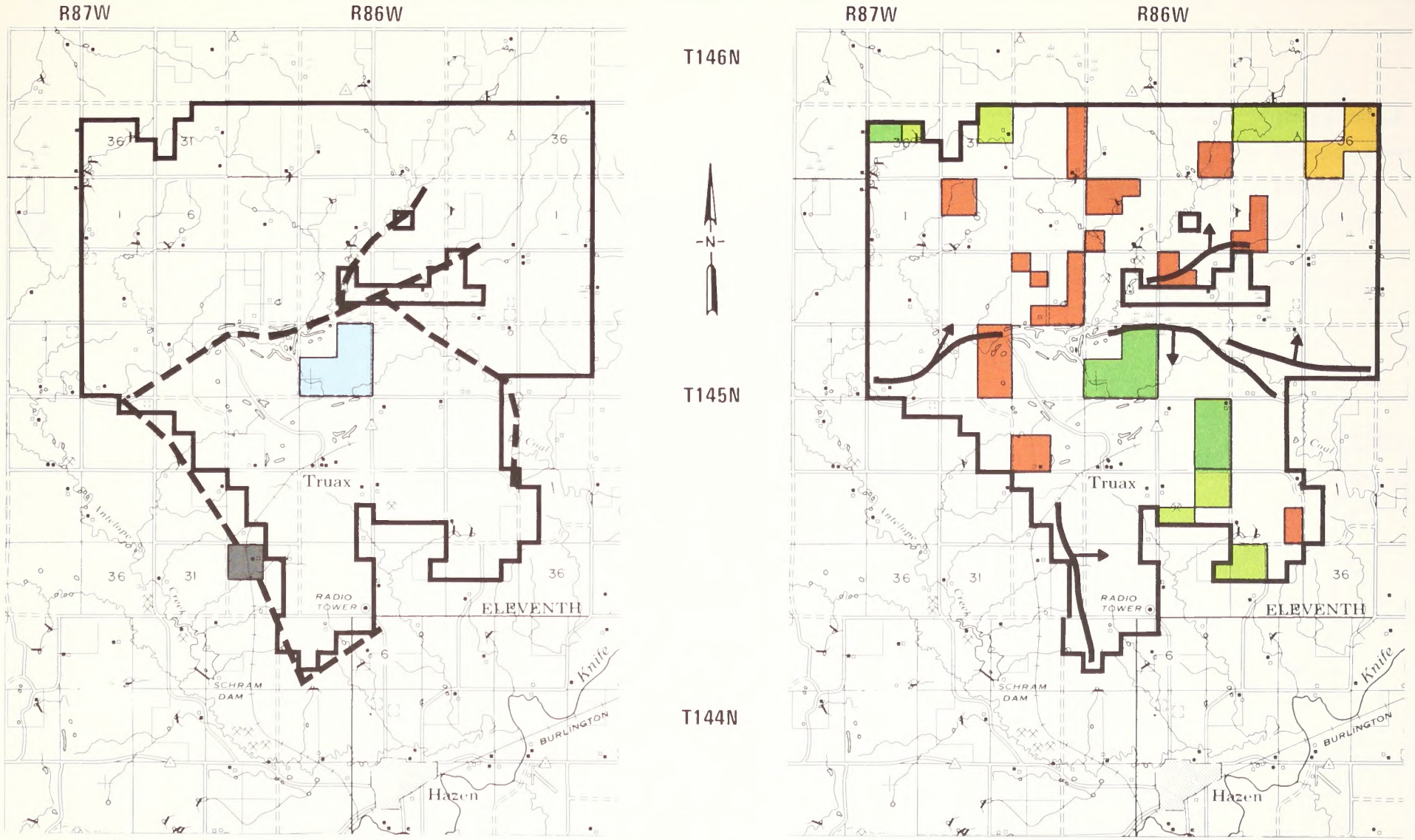
- Private Surface
- Tract Boundary
- Surface Facilities
- Mined Out Areas
- Out-of-Pit Haul Roads
- Federal Coal (100%)
- State Coal (50%)
- Private Coal
- Leased Coal
- Pit Advancement



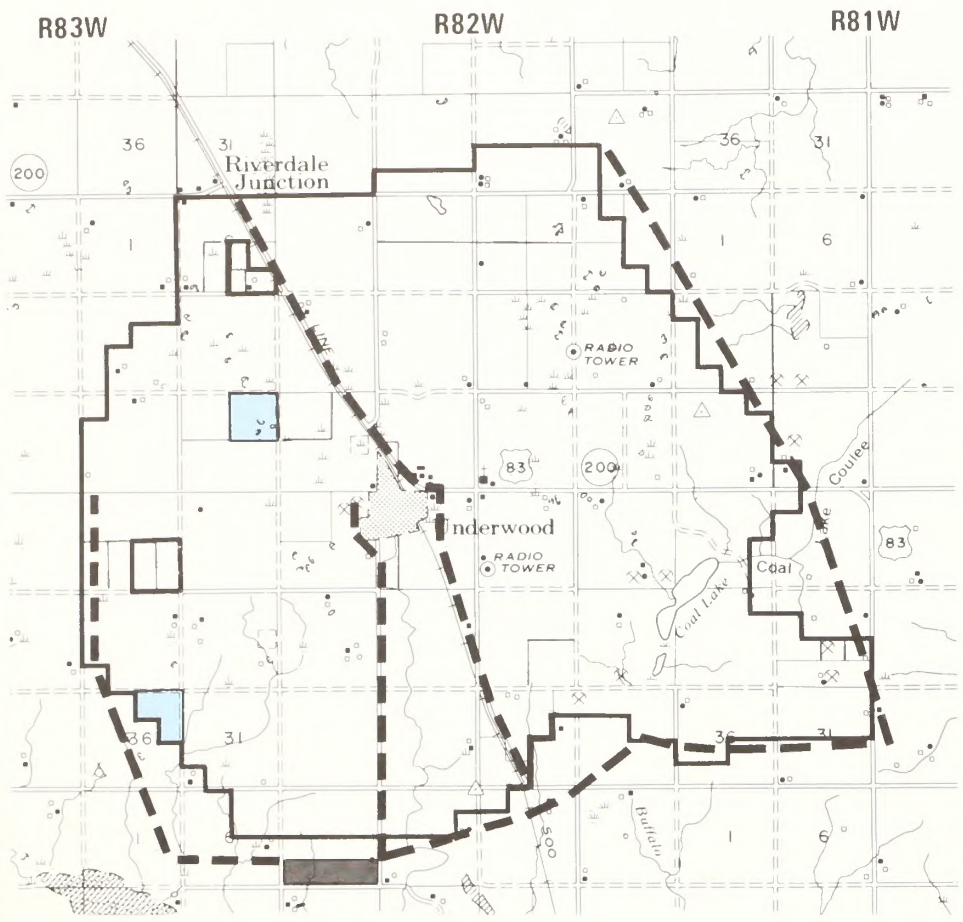
SUBSURFACE OWNERSHIP

1 0 1 2 3 4 5 6

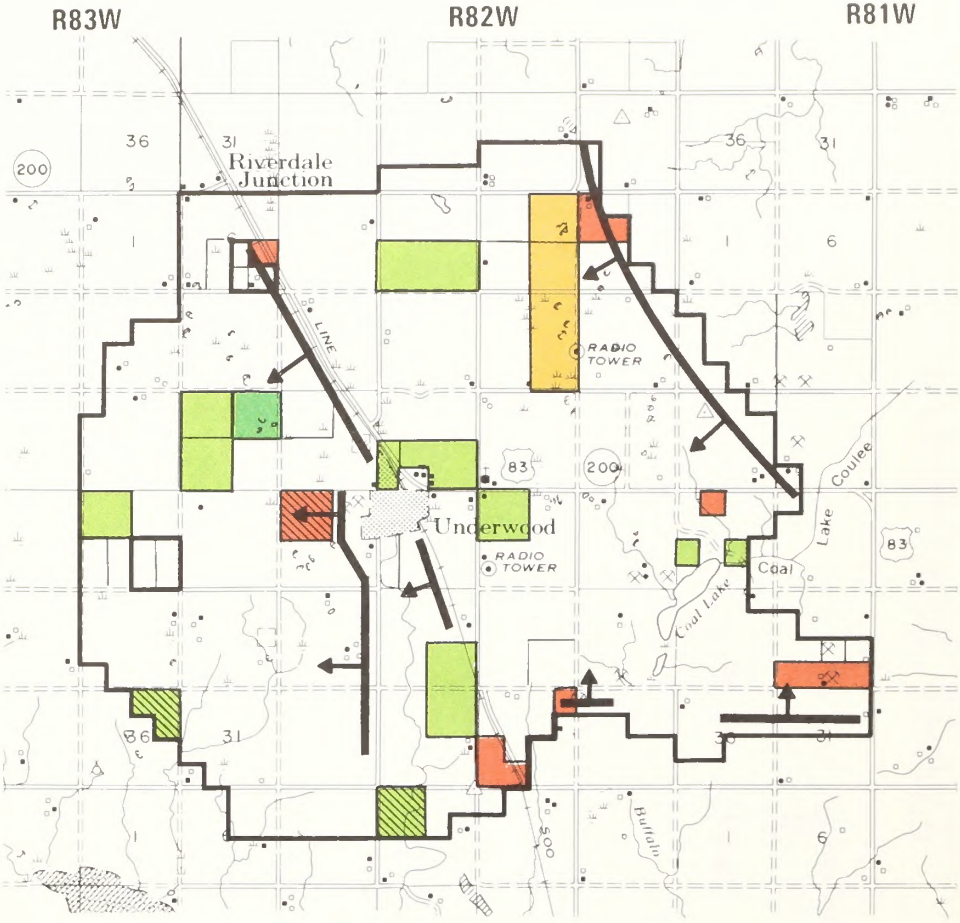
Scale In Miles


R87W
R86W
T146N
T145N
T144N
N
Truax
Intake
Coal
RADIO TOWER
ELEVENTH
SCHRAM DAM
Knife
BURLINGTON
Hazen
36
31
1
6
SURFACE OWNERSHIP
SUBSURFACE OWNERSHIP
TRUAX TRACT
LEGEND
State Surface
Private Surface
Surface Facilities
Tract Boundary
Out-of-Pit Haul Roads
Federal Coal (100%)
Federal Coal (Less than 100%)
State Coal (100%)
State Coal (Less than 100%)
Private Coal
Pit Advancement
1 0 1 2 3 4 5 6
Scale In Miles

UNDERWOOD TRACT



SURFACE OWNERSHIP



SUBSURFACE OWNERSHIP

LEGEND

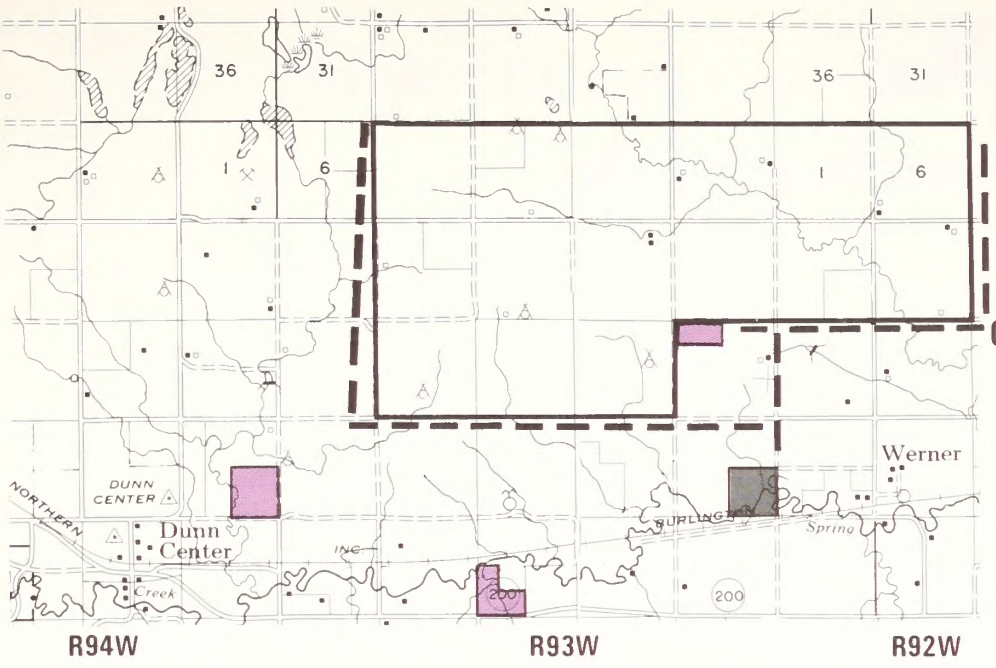
- State Surface
- Private Surface
- Tract Boundary
- Surface Facilities
- Out-of-Pit Haul Roads
- Federal Coal (100%)
- Federal Coal (Less than 100%)
- State Coal (100%)
- State Coal (Less than 100%)
- Private Coal
- Coal Lease
- Pit Advancement
- Tract Boundary

-N-

1 0 1 2 3 4 5 6

Scale In Miles

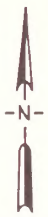
WERNER B TRACT

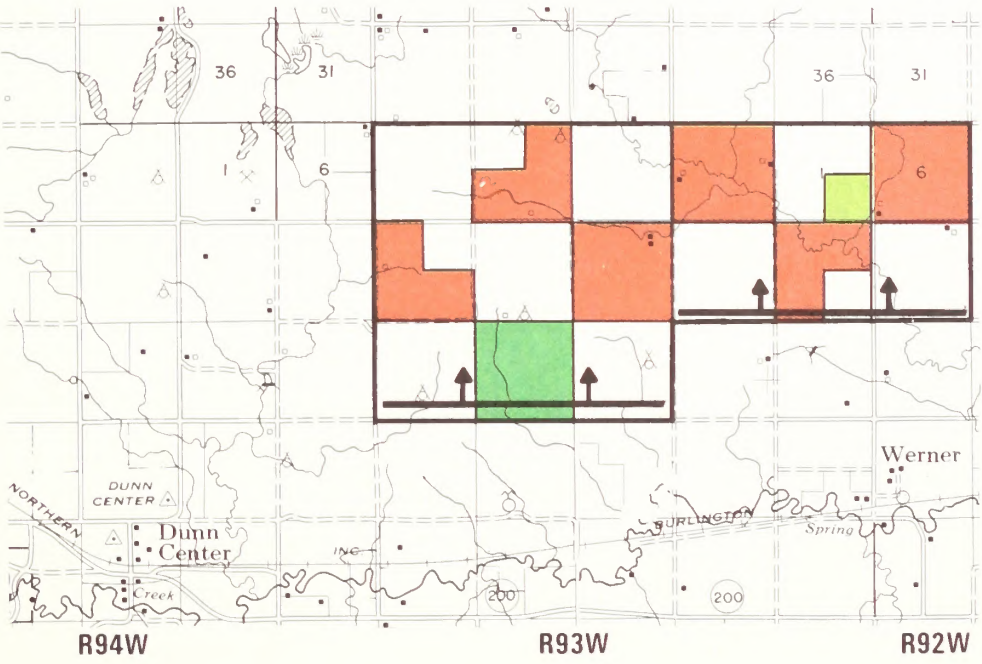


SURFACE OWNERSHIP

LEGEND

- Private Surface
- Surface Owner Nonconsents
- Tract Boundary
- Surface Facilities
- Out-of-Pit Haul Roads

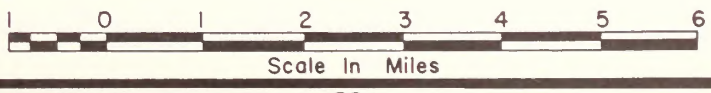




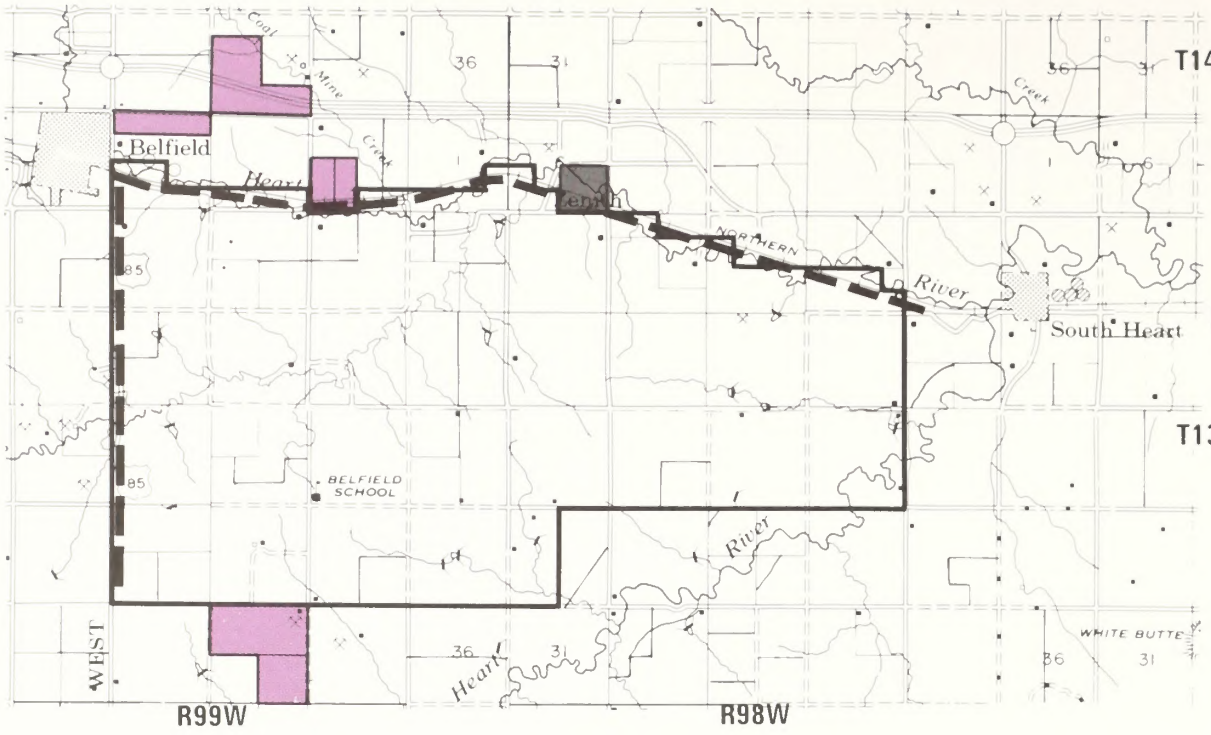
SUBSURFACE OWNERSHIP

LEGEND

- Federal Coal (100%)
- State Coal (100%)
- State Coal (Less than 100%)
- Pit Advancement



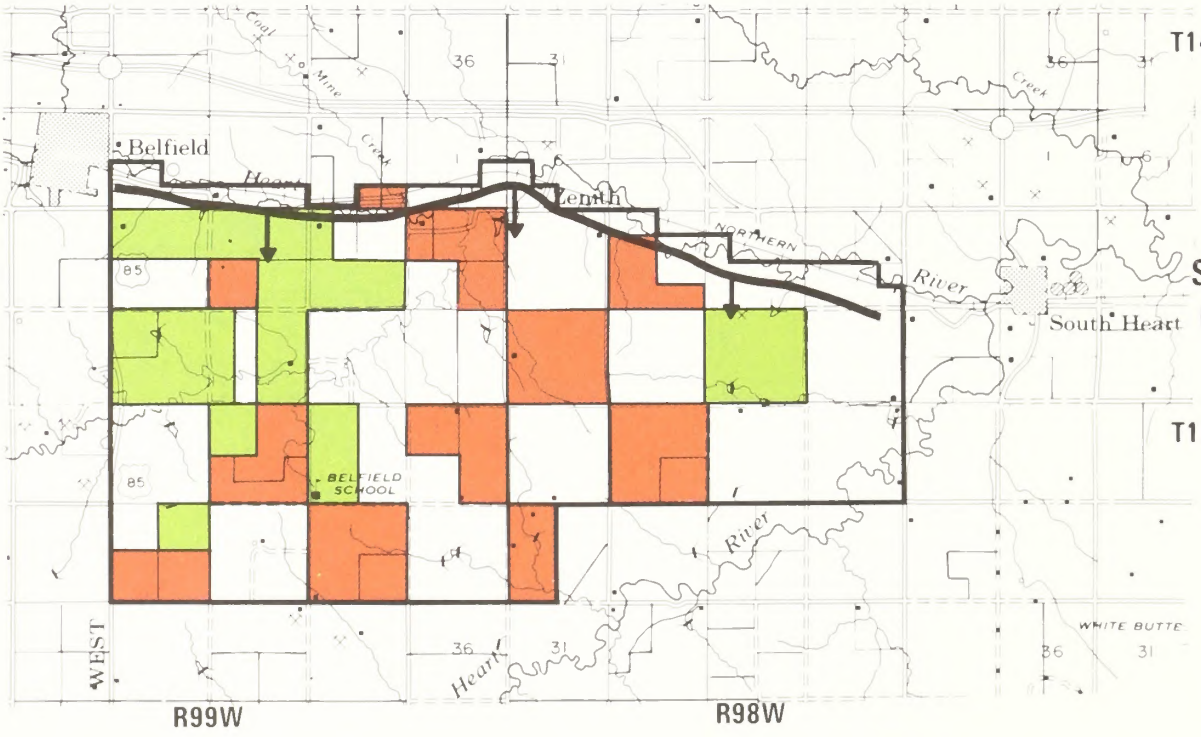
ZENITH TRACT



SURFACE OWNERSHIP

LEGEND

- Private Surface
- Surface Owner Nonconsents
- Tract Boundary
- Surface Facilities
- Out-of-Pit Haul Roads



SUBSURFACE OWNERSHIP

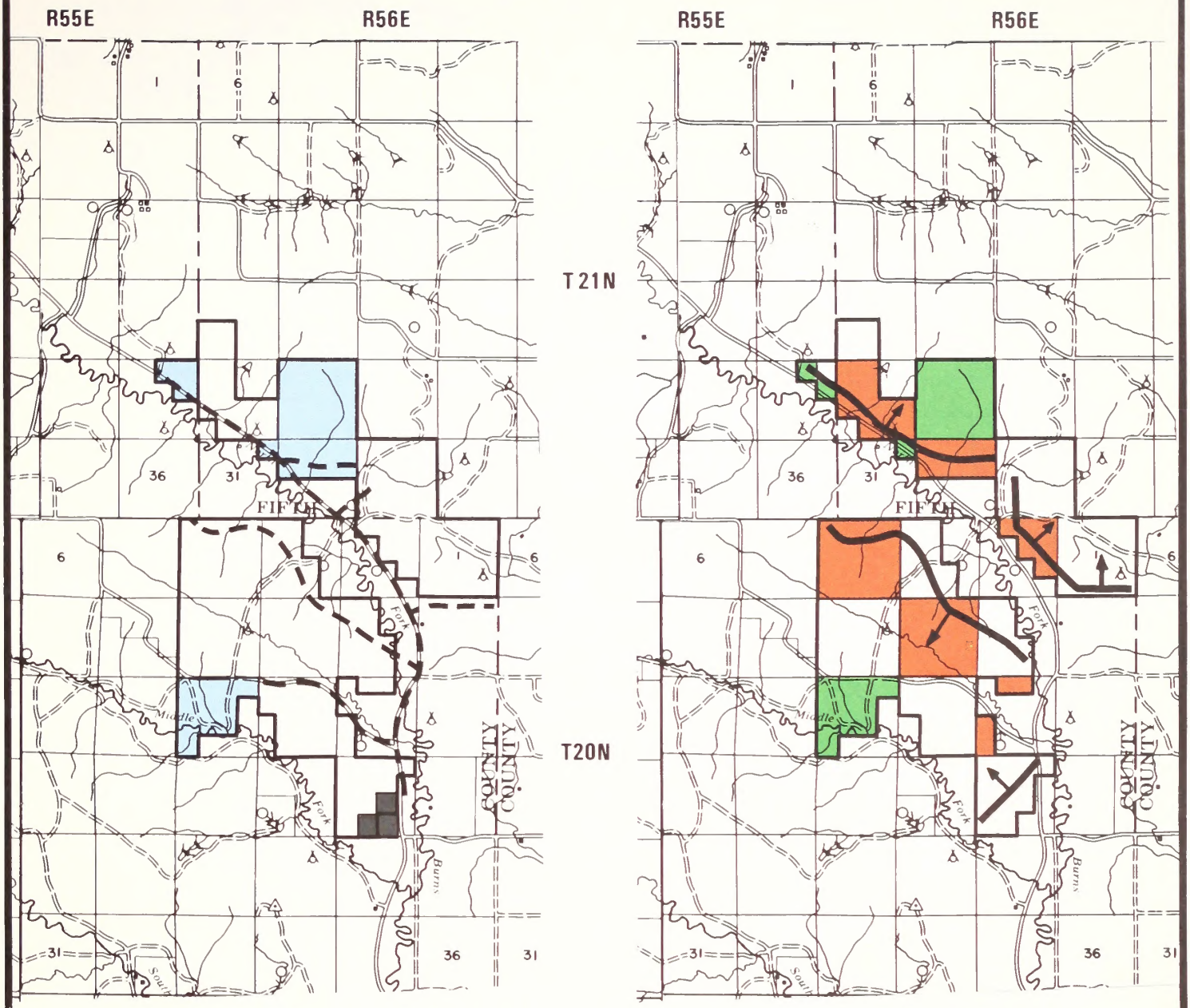
LEGEND

- Federal Coal (100%)
- State Coal (Less than 100%)
- Private Coal
- Pit Advancement

0 1 2 3 4 5 6

Scale In Miles

WOODSON PRLA



SURFACE OWNERSHIP

LEGEND

- State Surface
- Private Surface
- Surface Facilities
- Out-of-Pit Haul Roads
- Tract Boundary

-N-

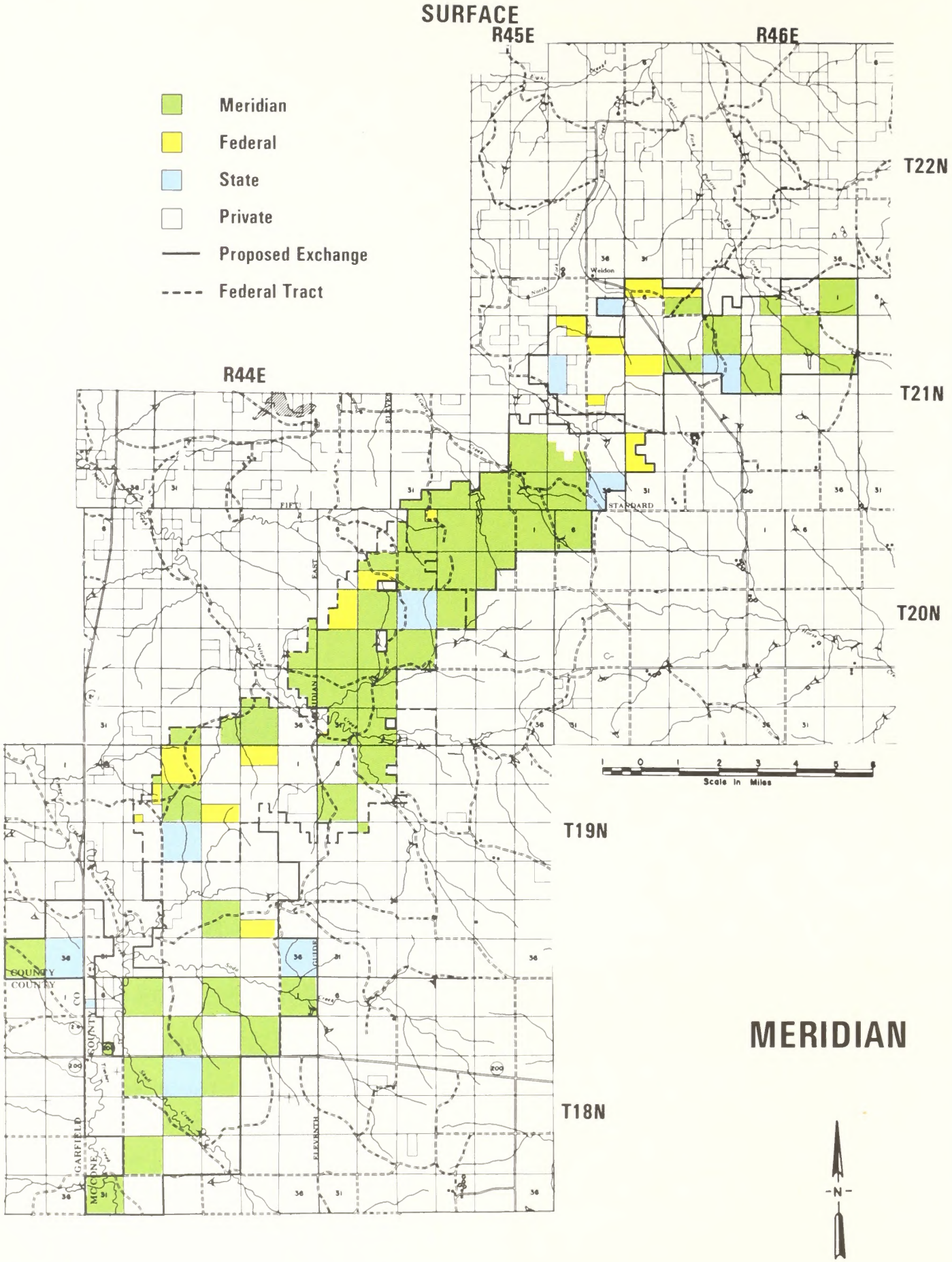
SUBSURFACE OWNERSHIP

LEGEND

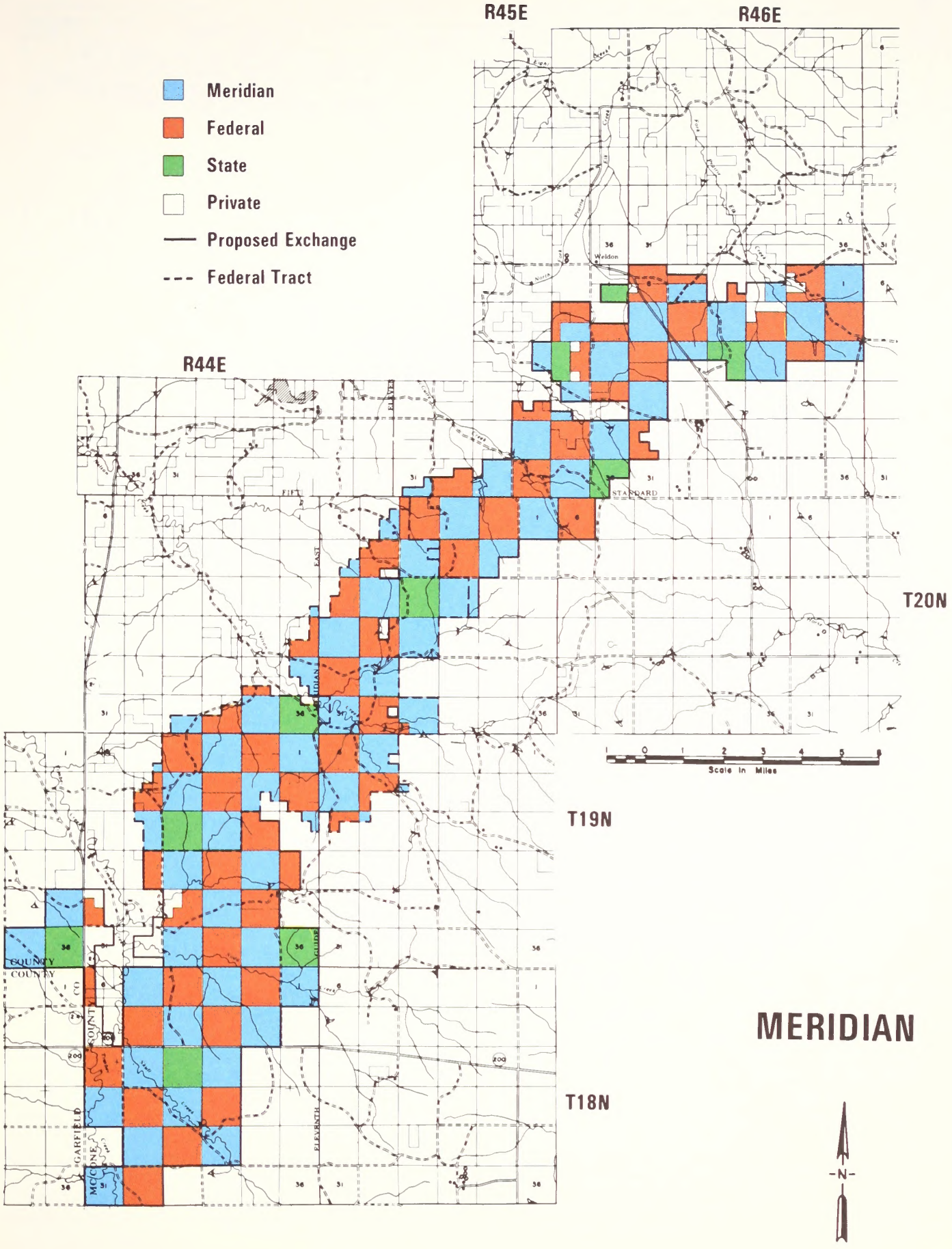
- Federal Coal (100%)
- State Coal (100%)
- Private Coal
- Pit Advancement
- Tract Boundary

1 0 1 2 3 4 5 6

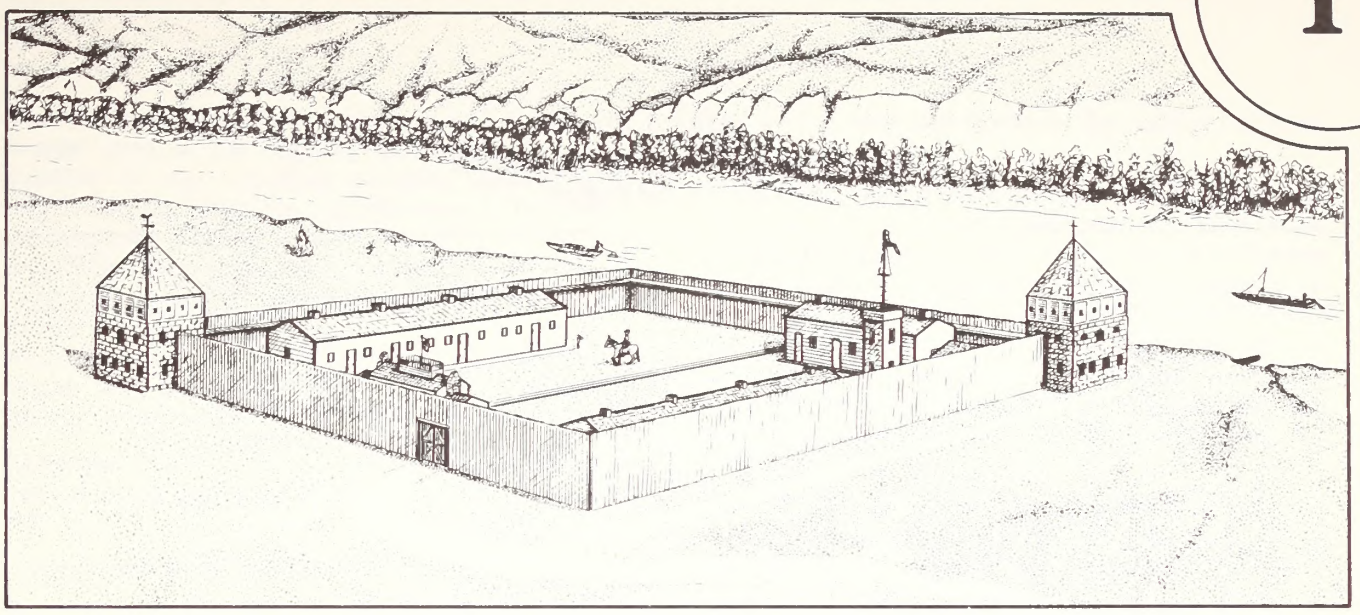
Scale In Miles


SURFACE
R45E
R46E
R44E
T22N
T21N
T20N
T19N
T18N
Meridian
Federal
State
Private
Proposed Exchange
Federal Tract
Weldon
STANDARD
FIFTH
EAST
ELEVENTH
GARFIELD
COUNTY
Scale in Miles
MERIDIAN
N

SUBSURFACE


R45E
R46E
R44E
Meridian
Federal
State
Private
Proposed Exchange
Federal Tract
T20N
T19N
T18N
Scale in Miles
MERIDIAN
-N-

CHAPTER 1



PROPOSED COAL LEASE ALTERNATIVES

This chapter describes the proposed federal coal leasing alternatives and the preferred leasing alternative selected by the Fort Union Regional Coal Team (RCT). These alternatives would make available, for leasing and potential production, various federal coal reserves, and include an analysis of no leasing, and a maximum level of leasing. The analysis of the consequences of leasing and developing each tract independently were published in the Site-Specific Analyses (SSAs). Of the 24 tracts evaluated by the team, 17 would be for new mine operations, while the other seven tracts constitute coal reserves needed to maintain production or prevent the by-pass of federal coal (see Map 1 in Map Packet).

Development of new mines in the Fort Union Coal Region have almost always been associated with a specific coal conversion facility in the vicinity of the mine. Therefore, the RCT decided that an evaluation of the impacts of a typical conversion facility near the mine was necessary. Although the RCT has included the facilities in this EIS, approval of such facilities is not a part of the action required to be covered in this document. Each facility associated with the tracts are assumed to be the type that might be constructed because of the availability of coal that would meet the demands of such facilities. These facilities are subject to separate analyses and approval by permitting agencies if and when they might be developed. In order to develop realistic information for the selection of the end-use facilities and obtain the best available data, each company which made an expression of interest was contacted. Where specific information related to a mine or facility was available, it has been used in the analysis. Table 1-1 shows the 24 tracts and the companies which expressed interest in a particular tract. Of the 24 tracts, seven tracts assume an end-use of electric power, five tracts assume an end-use of synthetic gas, and four tracts assume an end-use of synthetic liquids. Based on this assumption for end-use facilities, the leasing of the tracts would meet the coal demand for four power, two gasification, and three indirect liquefaction facilities in Montana; and three power, one gasification, one indirect liquefaction, and seven existing facilities in North Dakota. In addition, two gasification facilities could be developed from the leasing of the coal in two tracts that are located both in North Dakota and Montana. The final new production tract is a small business tract in North Dakota.

In analyzing the tracts and facilities on a regional basis, a number of assumptions were made to provide the basis for the impact analysis. These assumptions are included in this chapter. This chapter also describes the general stipulations associated with federal coal leasing and any special stipulations or agreements that have been developed and apply to specific tracts.

It should be noted that in addition to the six alternatives involving the 24 tracts, the regional implications of the Woodson Preference Right Lease Application (PRLA) and the Meridian Land and Mineral Company's (Meridian) proposed coal exchange are addressed in conjunction with Alternative 3.

TABLE 1-1
Tracts Selected for Alternative Analysis
Fort Union Coal Region

Tract	Total Acreage	Total Reserves Million Tons	Company Expressing Interest
1. Bloomfield	12,892	420.6	Kerr-McGee Corp; Burlington Northern
2. Burns Creek	16,330	535.8	U.S. Steel Corp.; Burlington Northern
3. Central Bloomfield	8,212	260.3	Kerr-McGee Corp; Burlington Northern
4. Circle West I	9,859	216.0	Wesco Resources, Inc.; Northern Resources, Inc.; Burlington Northern
5. Circle West II	11,024	245.7	Wesco Resources, Inc.; Northern Resources, Inc.; Burlington Northern
6. Circle West III	20,883	461.7	Wesco Resources, Inc.; Northern Resources, Inc.; Burlington Northern
7. North Wibaux-Beach	19,455	554.1	Tenneco Coal
8. Redwater I	22,786	463.5	Wesco Resources, Inc.; Burlington Northern
9. Redwater II	20,246	286.9	Wesco Resources, Inc.; Burlington Northern
10. South Wibaux-Beach	14,898	583.1	Tenneco Coal
11. Southwest Glendive	21,308	415.3	Tosco Corp.; Burlington Northern
12. Antelope	12,309	260.3	Coteau Properties Co.; Burlington Northern
13. Center	11,126	211.4	Baukol-Noonan, Inc.; Coteau Properties Co.; Burlington Northern
14. Dunn Center	20,657	562.2	Nokota Co.; Burlington Northern
15. Garrison	14,511	227.0	Utah International, Inc.; Burlington Northern
16. Glenharold	19,435	196.3	Consolidation Coal Co.; Baukol-Noonan, Inc.; Coteau Properties Co.; Burlington Northern
17. North Beulah	3,520	43.4	North American Coal Co.; Burlington Northern
18. Renner	22,367	368.9	Coteau Properties Co.; Burlington Northern
19. Sakakawea	1,360	8.2	
20. Schoolhouse	14,958	247.9	Knife River Coal Co.; Burlington Northern
21. Truax	23,460	282.8	Consolidation Coal Co.; Burlington Northern
22. Underwood	24,622	288.3	Falkirk Mining Co.; Burlington Northern
23. Werner	9,577	225.7	Nokota Co.; Burlington Northern
24. Zenith	18,393	486.7	Coteau Properties Co.; Burlington Northern

ASSUMPTIONS

The following assumptions were made to provide a basis for the analysis of the impacts of mining and the associated coal conversion facilities.

General

All relevant state and federal laws and regulations pertaining to coal mining and facility development will be enforced.

The analysis in this Environmental Impact Statement (EIS) will confine itself to discussing only the impacts of new mines and facilities over and above the baseline mines and facilities except where necessary to analyze the production maintenance or by-pass tracts.

The baseline for coal production and development includes all of the mines and facilities listed in the baseline tables. The baseline was developed on the basis of those mines and facilities which have received approvals or permits to construct and are currently under construction or in operation.

The baseline for the resources would be the information presented for the production maintenance/by-pass tracts except for the economic, air, and social sections which included workforce, population, and air emission rates existing throughout the region. This regional information was based on four additional mine and facilities shown in the baseline tables, but are not a part of the production maintenance/by-pass tracts.

The Montana State Office Economic/Demographic model used in the Regional EIS contains a large number of user specified variables (assumptions) which directly affect the model's output. The major assumptions which can be changed to modify the model predictive capability for a particular region are: birth rate, family size, community attraction index, workforce participation rate and unallocated labor pool. As these values are changed, the model's overall economic and demographic forecast for a region will change accordingly.

State and privately owned coal included or adjoining federal lease tracts would be developed simultaneously with federal coal in a logical mining sequence.

Consumption of coal would occur on-site.

In analyzing each alternative, it is assumed that all mines and facilities will be developed.

A buffer zone would be considered for any existing oil wells on the tract. Some pipelines may have a 100-foot buffer or be relocated around the tract.

Industry would not provide advanced funding to local impacted communities as a means to mitigate impacts caused by energy development.

Mining

A strip mine would be developed according to the generic mining plan described in the SSA. This would include using draglines, electric shovels, bottom-dump coal haulers, scrapers and other support equipment.

All lands within the tract boundaries would be disturbed to some degree.

Reclamation would proceed concurrently with mining operations.

Coal Mine Loading Operation at the Glenharold Mine

Post-mining land use would be the same as the pre-mining use.

Information related to employment, acreages, coal reserves, and water needs has been provided in the tables for each alternative and is displayed in Figures 1-1 through 1-5. Where current information has been made available by industry for a specific project related to the tracts, these numbers have been used and will differ from those used in the generic mine. However, it is recognized that the company which provided the information may not be the successful bidder at the lease sale.

The sequence of development for the generic mine will be used unless otherwise indicated. Mine construction would begin in 1988 with initial production of the mine occurring in 1990.

Full production of the mine would occur about two years after initial production.

For additional information on the individual mines, refer to the SSA.

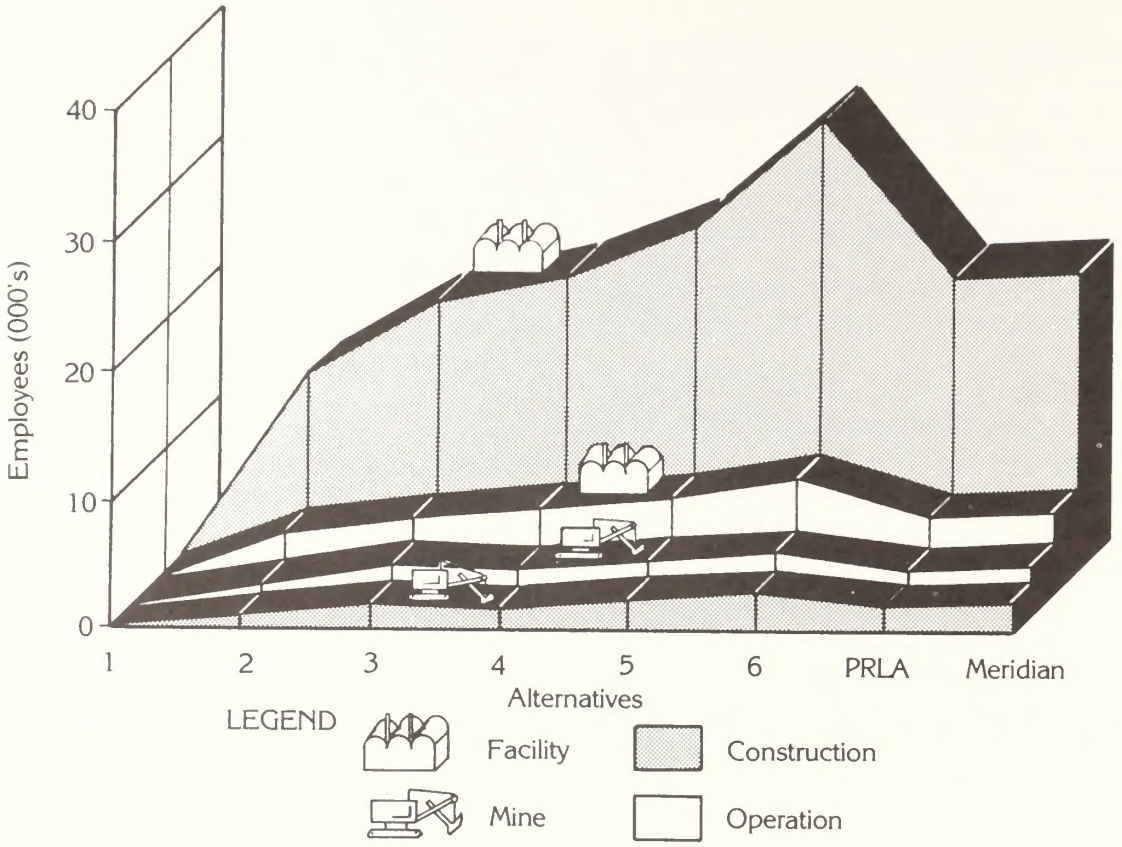
Facilities

The generic facility is assumed to be located near the tract. For analytical purposes, this will be the center of the tract. Where information is available on a more likely site, it is used in the facility analysis.

The Basin Electric Leland Olds Power Plant

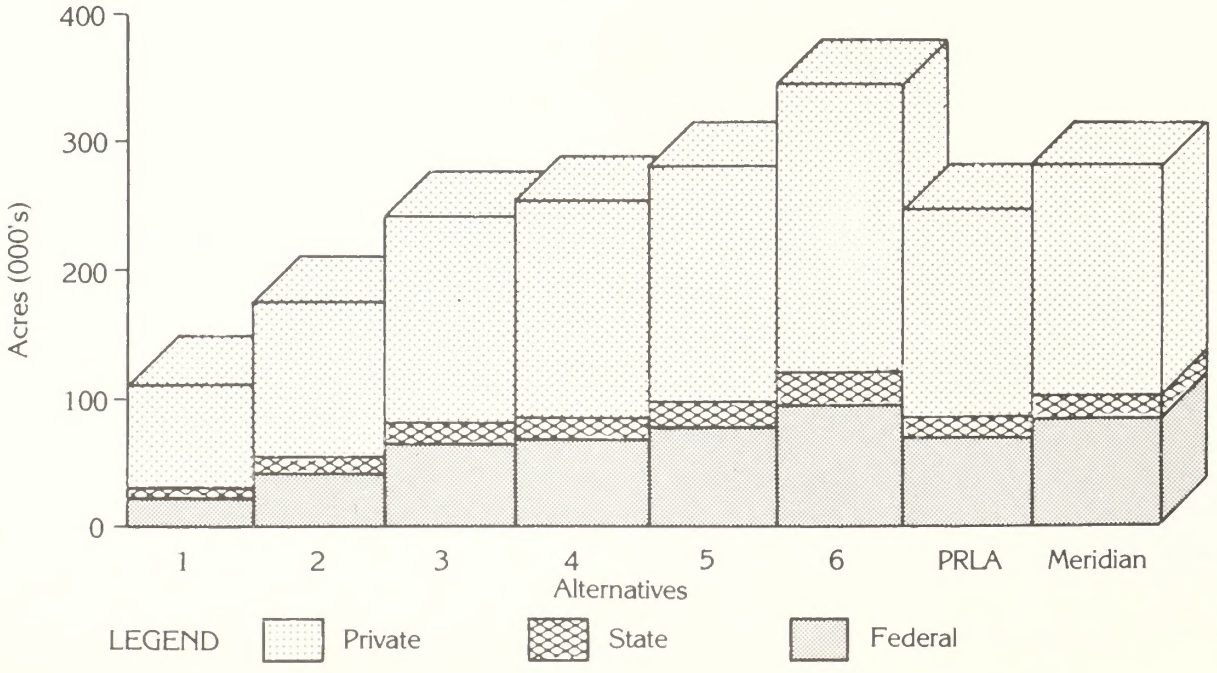
The type of generic facility assumed for each tract is shown in the tables for each alternative. The types of generic facilities include a 1000-megawatt electric power facility, a 250 million standard cubic feet per day synthetic gas facility, and an 85,000-barrel per day synthetic liquid fuel facility. Figure 1-6 depicts a typical gasification plant and the relative magnitude of products and by-products based on an earlier designed facility.

FIGURE 1-1 INCREASED EMPLOYMENT OVER BASELINE BY ALTERNATIVE FOR MINES AND FACILITIES



Note: Baseline employment for mines and facilities are approximately 1,790 and 2,220, respectively.

FIGURE 1-2 COAL OWNERSHIP FOR THE TRACTS WITHIN EACH ALTERNATIVE



Unless specific information is available on the time frame for construction and operation of a facility, all generic facilities will begin construction and operation using the following sequence:

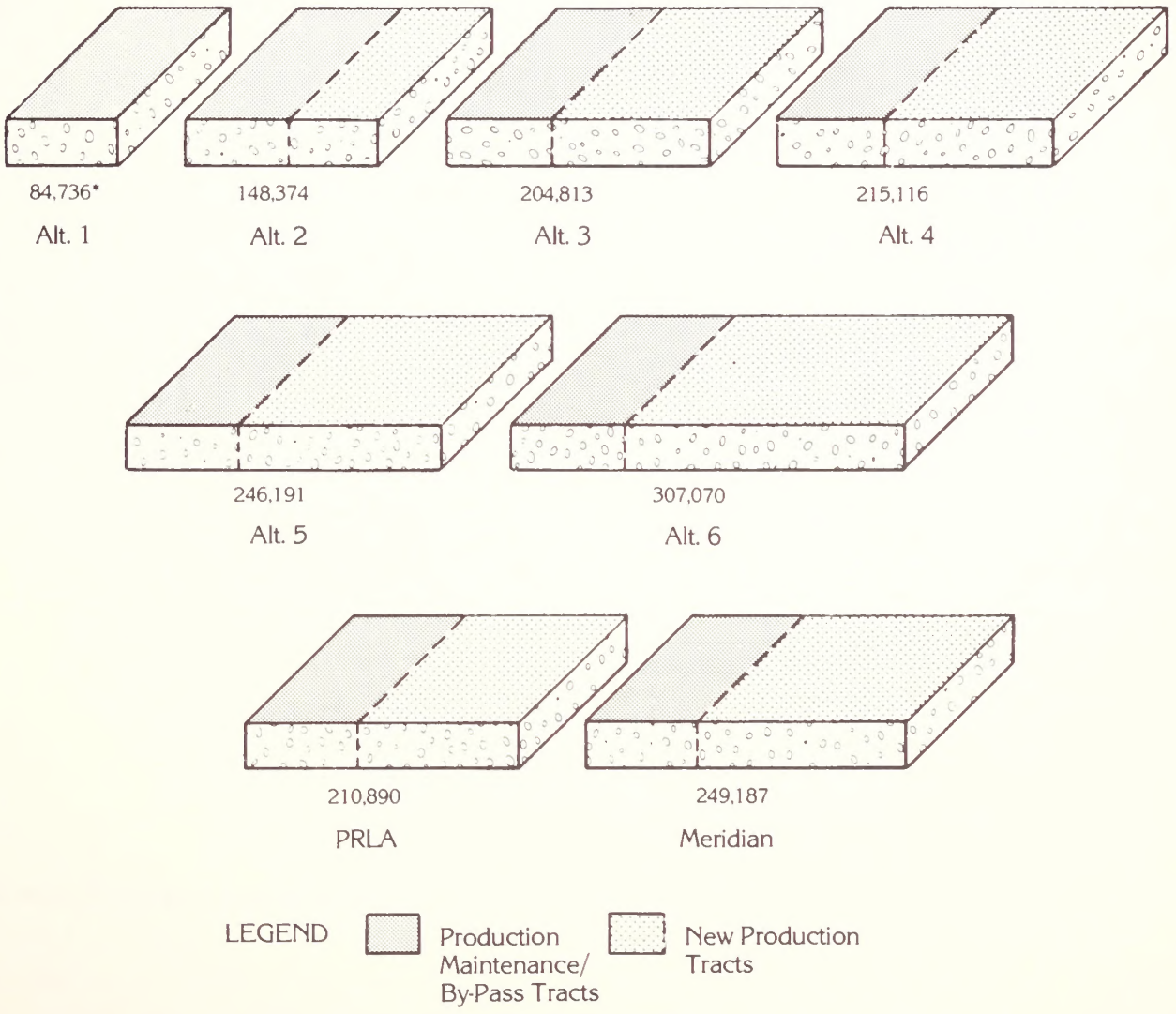
An electric power plant would begin construction of the first unit in 1988 and be in operation in 1991. Construction of the second unit would begin in 1992 and be operational by 1995.

A gasification or indirect liquefaction plant would begin construction of the first half of the facility in 1988 and be operational in 1992. The second half of the facility would begin construction in 1992 and be in operation by 1997.

The assumptions related to the number of employees, acreages, water requirements, and air emission rates are shown in the tables for each alternative and in Figures 1-1, 1-3, 1-5, and 1-7.

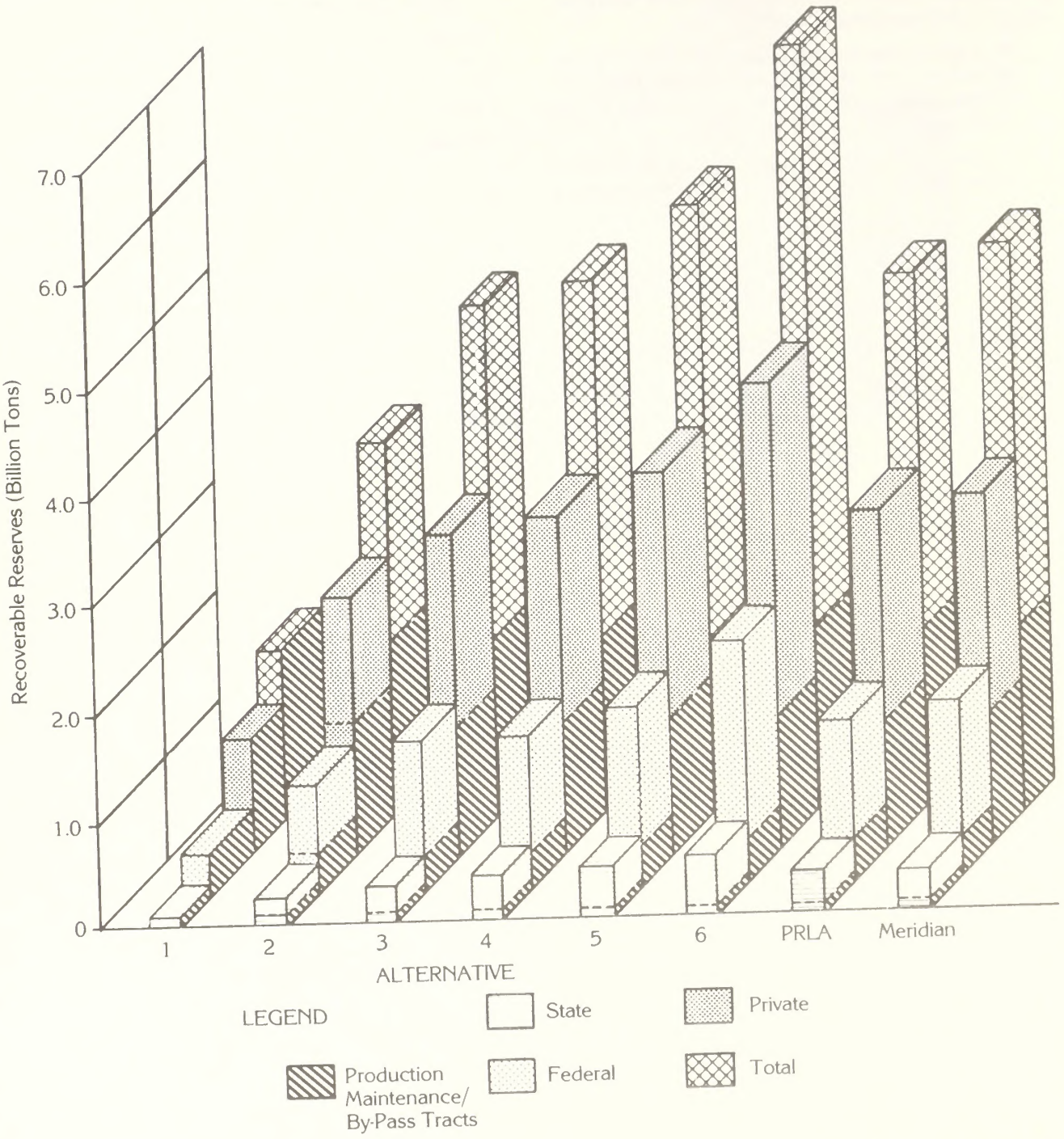
A full description of the respective generic facilities can be found in the Preliminary Facility Evaluation Reports (PFERs) which are a part of the SSAs.

FIGURE 1-3 TOTAL TRACT AND FACILITY DISTURBED ACREAGE BY ALTERNATIVE



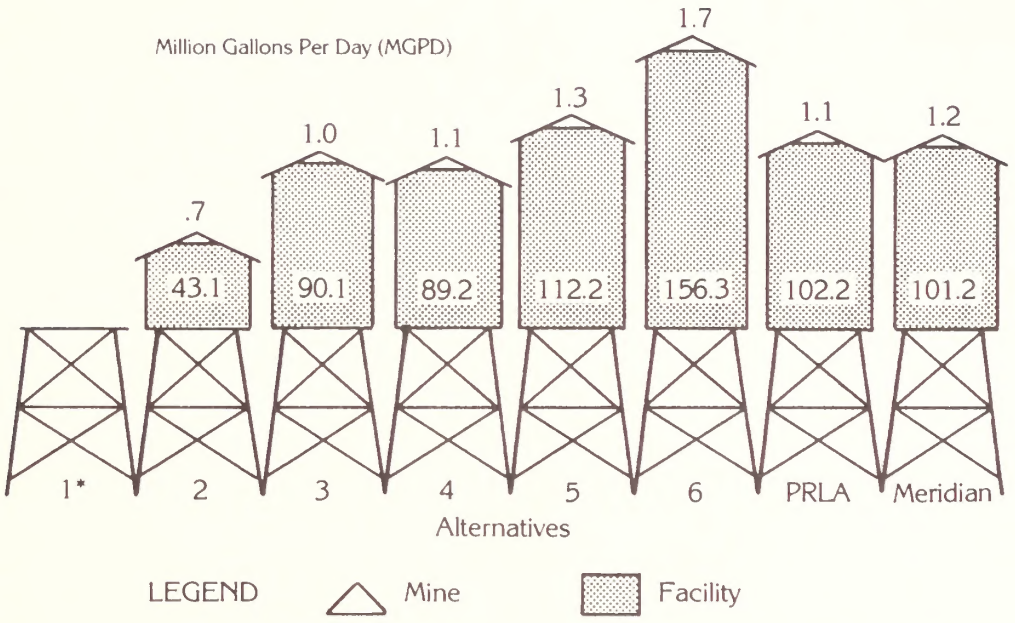
*This figure, in addition to the Velva, Husky, Gascoyne, and Savage mines (approximately 8,780 acres), constitutes acreages within the region committed to disturbance.

FIGURE 1-4 OWNERSHIP OF RECOVERABLE RESERVES FOR THE TRACTS WITHIN EACH ALTERNATIVE



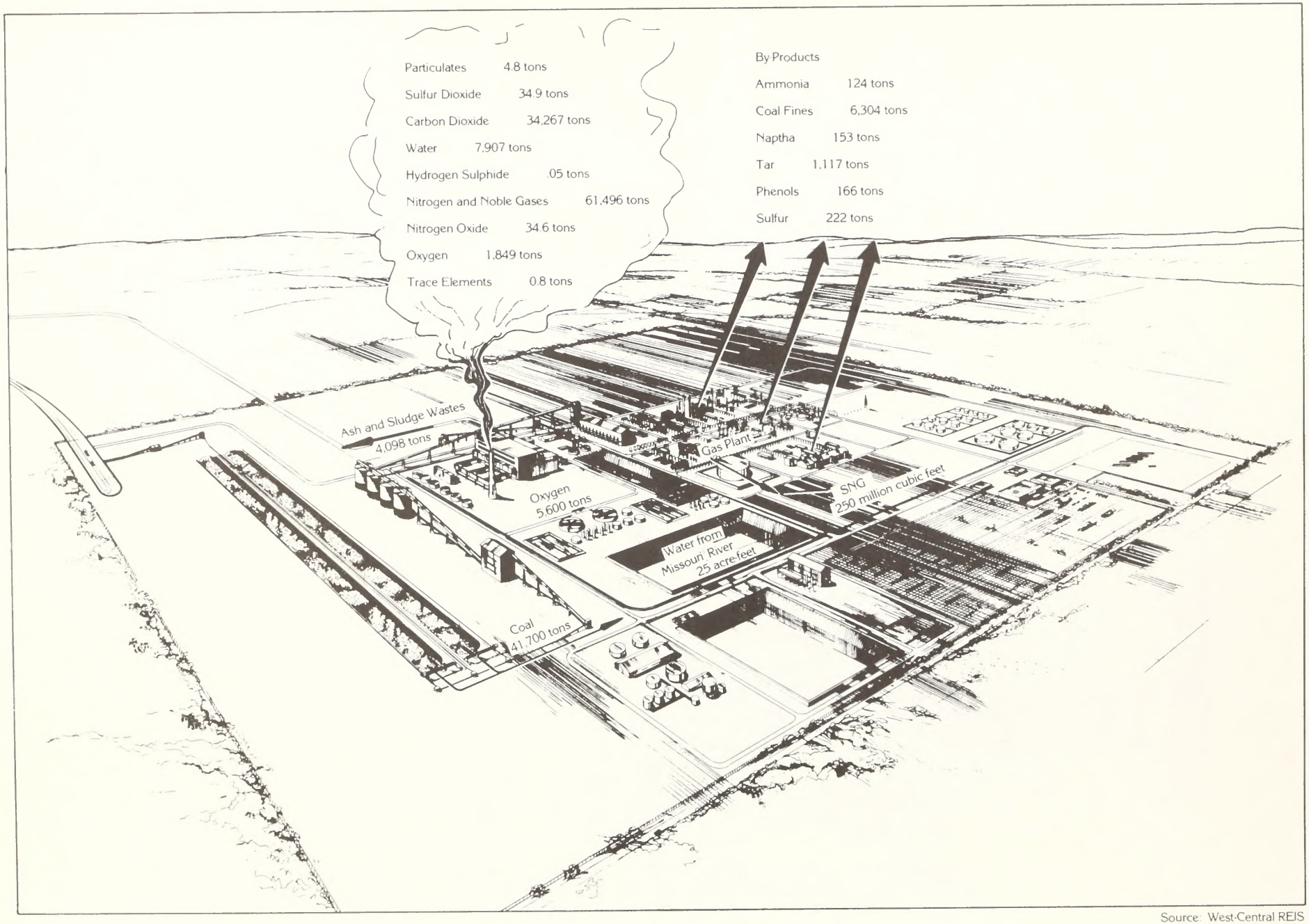
Note: All reserves over production maintenance/by-pass are new production reserves.

FIGURE 1-5 TOTAL WATER NEEDS BY ALTERNATIVE



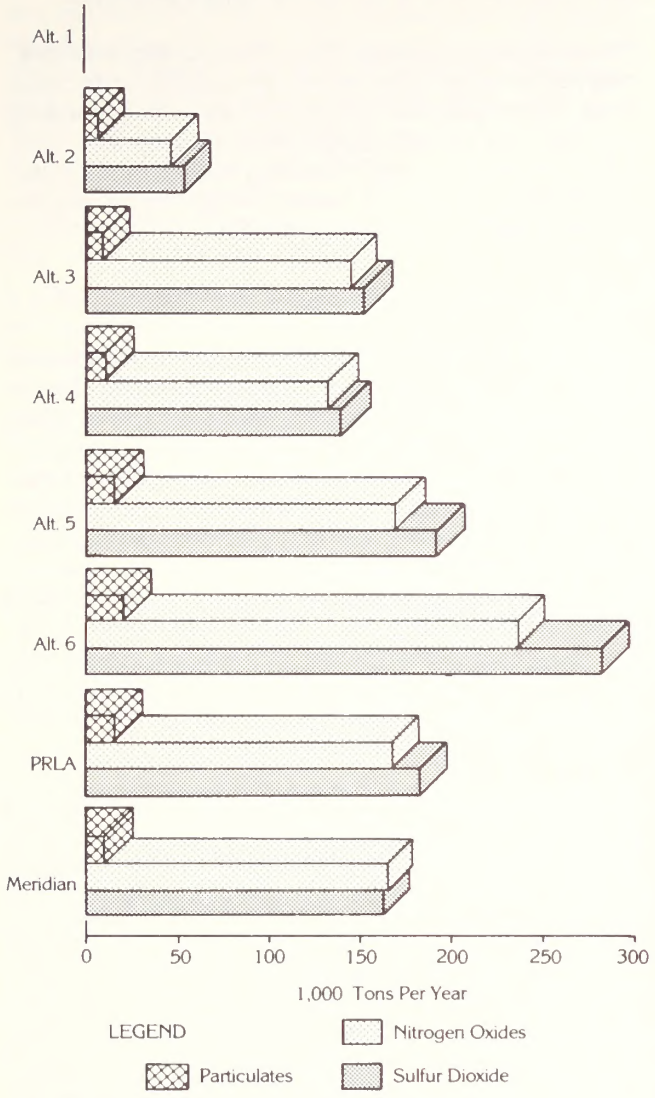
* All mines and facilities in this alternative are either operational or under construction and would not require additional water needs. (Estimated current water use is .5 MGPD for mines and 43.7 MGPD for facilities.)

FIGURE 1-6 RELATIVE MAGNITUDE OF PRODUCTS AND BY-PRODUCTS FROM A 1976 DESIGNED GASIFICATION FACILITY



Source: West-Central REIS

FIGURE 1-7 AIR EMISSION RATE BY ALTERNATIVE



Ancillary Facilities

Various ancillary facilities are associated with each type of facility. The assumptions below will be used to evaluate these facilities.

A railroad spur would connect the facility with an existing rail system. The spur would have a 150-foot right-of-way.

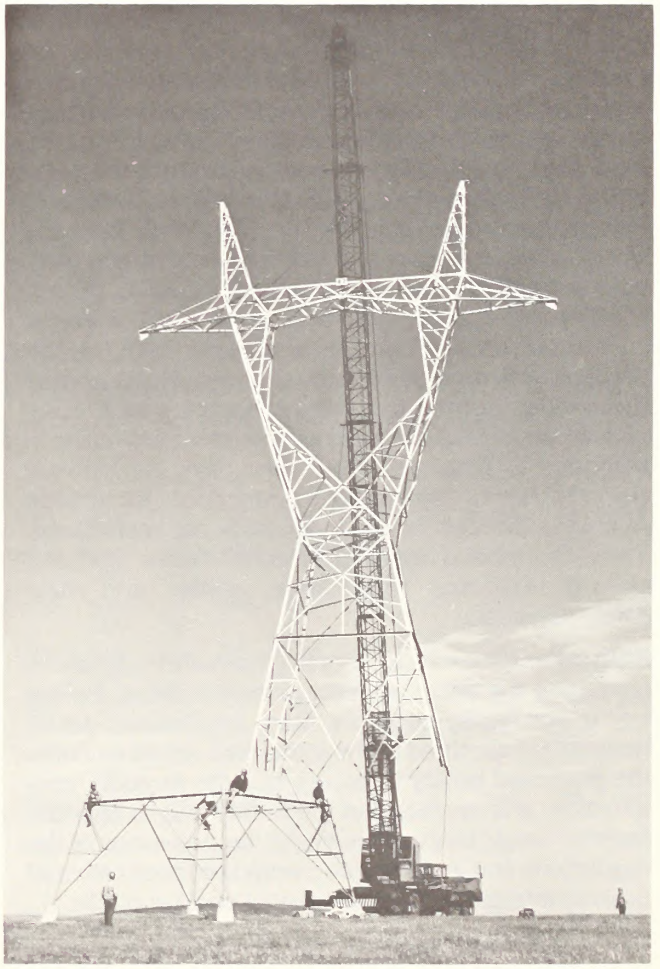
Access roads would be required to each facility. These roads require a 50-foot right-of-way.

Water pipelines would be required from the water source to the facility. These pipelines will require a right-of-way 100 feet in width for construction and 50 feet wide permanently.

Surge ponds associated with electric power facilities would have a surface area of approximately 42 acres and contain 1050 acre-feet of water.

Transmission lines from electric power facilities would be 500 Kv lines requiring a right-of-way width of 200 feet.

Pipeline and Right-of-way Needed for Construction



Transmission Tower Being Constructed with Associated Right-of-way Disturbance

GENERAL STIPULATIONS

The development of federal coal resources must be carried out in compliance with existing federal and state laws and regulations. The Surface Mining Control and Reclamation Act of 1977 (SMCRA) provides for state regulation of surface mining and reclamation on state and private lands as well as federal lands under the terms of a cooperative agreement between the Department of the Interior and the States of Montana and North Dakota. Both states have the primary responsibility for assuring that standards are maintained for regulating surface mining and reclamation. The regulations that have been developed address the environmental protection standards for coal mining. Some of the standards which have been covered include restoration of the land to a condition capable of supporting the uses that it was capable of supporting prior to mining, use of explosives in accordance with state and federal laws, establishment of permanent vegetative cover on areas affected by mining, segregation and replacement of the individual horizons of topsoil removed from prime farmland, and the assumption of responsibility for successful vegetation on the mined area for a given period of time.

Each lease operator is required to submit a mining and reclamation plan that complies with the rules and regulations of the North Dakota Public Service Commission, the Montana Department of State Lands, the Office of Surface Mining (OSM), or the U.S. Minerals Management Service (MMS). The MMS has the responsibility to assure that both efficient mining practices are utilized and environmentally sound mining practices are applied to the development of the federal coal to protect the new coal resources. OSM has the responsibility on federal lands to approve mining and reclamation permit applications, assure permit compliance, and designate lands as unsuitable for mining in response to petitions. The states have the primary responsibility to assure that the standards for surface mining and reclamation on all lands are maintained. These regulations deal with water conditions, land use, cultural resources, reclamation, wildlife, and mine safety practices.

Both states have developed siting rules and regulations governing the siting of major energy facilities. Before any major facility could be sited, applications would have to be submitted to the states who would evaluate the proposed facility to assure that the location, construction, and operation of the facility and its ancillary facilities would be consistent with the provisions of the regulations and that the siting would produce minimal adverse effects on the environment and the public.

SPECIAL TRACT STIPULATIONS

Tract conditions, based on the individual tract analyses, may require special stipulations be included on the coal lease. These would be mitigating measures that would normally not be addressed within existing state and federal regulations. The following special stipulations for wildlife and cultural resources are being recommended based on analysis in the SSAs.

Wildlife Resources

Wetlands, woodlands, and native rangelands destroyed during mining would be restored or replaced unless this conflicts with the lawful desires of the surface owner. Mining of these areas would not be allowed by the state without demonstration of satisfactory restoration or replacement. The decision as to whether or not these areas can be restored or replaced would be made at the mine plan review stage and this determination would be made on a site-by-site basis. The North and South Wibaux-Beach tracts would have stipulations that require restoration of specific wetlands. Southwest Glendive, Circle West I, Circle West II, Circle West III, and Redwater II are covered by stipulations protecting sharp-tailed grouse and critical antelope range.

View of Pothole Region of North Dakota

Cultural Resources

To consider the archaeological sites eligible for mining in Sections 32 and 34, T145N, R93W of the Dunn Center tract, BLM will require documentation that the

adverse affects of mining on the sites can be mitigated through data recovery. This mitigation plan will be prepared at mine plan stage by the party impacting the sites and will be reviewed by the State Historic Preservation Officer (SHPO), interested publics, BLM, OSM, and the President's Advisory Council on Historic Preservation. The preparation of the mitigation plans should be guided by the Advisory Council on Historic Preservation handbook titled "Treatment of Archaeological Properties," dated November 1980.

A management plan would be developed for other archaeological sites in the Dunn Center tract that would be impacted by development of the Dunn Center Tract. This plan containing a detailed mitigation plan for each site to be impacted by mining will be reviewed by the BLM and the SHPO, and approved by OSM. Archaeological sites in the Glenharold tract would require a management plan similar to the Dunn Center tract.

DESCRIPTION OF ALTERNATIVES

Alternative 1—No Leasing or Production Maintenance/By-Pass Leasing

This alternative was selected to analyze those coal tracts necessary for production maintenance of existing mines or to prevent the by-pass of federal coal. In addition, this alternative will evaluate the consequences of not leasing any additional federal coal. The Antelope, Center, Glenharold, North Beulah, Renner, Schoolhouse, and Underwood tracts were selected for the production maintenance/by-pass leasing analysis (see Map 1 in Map Packet) and would make 203.2 million tons of new federal coal available for existing operations. The existing mines are associated with six power plants and one gasification plant located in North Dakota which are either under construction or in operation. Information related to the seven tracts is shown in Table 1-2.

In the no action or no additional federal leasing analysis, it is assumed that the leasing of the production maintenance/by-pass tracts would not increase overall coal production for the Beulah, Center, Falkirk, Gascoyne, Glenharold, Husky, Indianhead, Savage, and Velva mines. In addition, it is assumed that mine and facility employment, disturbed acreage, water needs, and air emission rates would not increase within the region.

The mines and facilities shown in Table 1-3 are the baseline for coal production and development. These mines and facilities are the same mines that would be associated with the production maintenance/by-pass tracts in Table 1-2 except for the Gascoyne, Husky, Savage, and Velva mines. Additional information for the baseline mines and facilities are shown in Tables 1-3 and 1-4. The figures presented in Table 1-2 for the production maintenance/by-pass tracts is summary information related specifically to those delineated tracts and does not represent additional disturbance or impacts for the baseline mines. All of the mines are located in North Dakota except the Savage mine which is located in Montana. In addition the Beulah-Hazen mine is currently under development to supply coal to

TABLE 1-2
Alternative 1 — No Leasing or Production Maintenance/By-Pass Leasing

Tract	Facility Type	Annual Prod. (tons x 10^6)	Recoverable Reserves (tons x 10^6)				Tract Acreage				Mined Acreage				Other Disturbed Acres					
			Federal	State	Private	Total	Federal	State	Private	Total	Federal	State	Private	Total	Mine Facility	End-Use Facility	Roads/ Power Lines/ Pipelines	Total	Tot. Tract & Fac. Disturb.	Product Trans.
Antelope	Existing Facility	5.2	12.5 16.1*	4.3	227.4	260.3	638 677*	320	10674	12309	608 446*	160	8687	9901	0	0	120	120	10021	Existing
Center	Existing Facility	4.2	19.1 30.9*	3.6 5.4*	152.4	211.4	872 1485*	100 640*	8029	11126	816 1301*	40 382*	6640	9179	0	0	127	127	9306	Existing
Glenharold	Existing Facility	3.8	39.7 25.1*	5.6	125.9	196.3	3372 2229*	862	12972	19435	2655 1297*	474	8312	12738	0	0	248	248	12986	Existing
North Beulah	Existing Facility	1.1	6.4	2.8 7.5*	26.7	43.4	720	480 480*	1840	3520	316	178 419*	1407	2320	0	0	92	92	2412	Existing
Renner	Existing Facility	9.0	80.0 49.6*	37.5	201.8	368.9	6262 2121*	2100	11884	22367	4363 1669*	1486	8871	16389	0	0	298	298	16687	Existing
Schoolhouse	Existing Facility	5.0	38.7 27.0*	3.5 6.6*	172.1	247.9	3001 1200*	320 479*	9958	14958	1665 998*	320 177*	7419	10579	0	0	188	188	10767	Existing
Underwood	Existing Facility	5.6	6.8 2.2*	8.0 2.3*	269.0	288.3	839 160*	976 200*	22447	24622	696 160*	955 162*	20254	22227	0	0	330	330	22557	Existing
EXISTING TOTAL		33.9	203.2 150.9*	65.3 21.8*	1175.3	1616.5	15704 7872*	5158 1799*	77804	108337	11119 5871*	3613 1140*	61590	83333	0	0	1403	1403	84736	

* Currently Leased

Note: These figures represent continued operation of mines and facilities associated with the production maintenance/by-pass tracts. Acreage figures would be similar whether or not federal coal is leased. Only reserve ownership would change appreciably. The figures do not reflect information on the Gascoyne, Husky, Savage, and Velva mines.

the Great Plains Coal Gasification Plant and the Antelope Valley Power Plant. This mine and the facilities are included in the baseline because they have been approved and permitted and are currently under construction. The Woodson PRLA is also considered a part of the baseline coal production for the region; however, for analysis purposes, it is only discussed in relation to Alternative 3.

In relation to the no action option, the baseline mines would have continued impacts associated with continued mining operations but this would not result from new coal production rates. It is forecasted that the baseline mines would produce 32.7, 38.4, and 42.1 million tons of coal per year for 1985, 1990, and 1995, respectively, whether additional federal coal is leased or not. This means that the acreages that would be disturbed should be approximately the same; however, the location of that disturbance would vary with coal ownership.

TABLE 1-3
Baseline Coal Production and Development

Mine	Preliminary Logical Mining Unit	Coal Company	Production Forecast Per Mine Million Tons/Year 85	90	95	Facility	Type/Size	Consumption Forecast Per Facility Million Tons/Year 85	90	95
Beulah	Schoolhouse	Knife River	4.3	5.0	5.0	Coyote #1	Power Plant 440 MW	2.2	2.2	2.2
	Schoolhouse					Other Facilities	Various	2.1	2.8	2.8
Beulah Hazen	Antelope	Coteau Properties				Antelope Valley #1 and #2	Power Plant 876 MW	5.2	5.2	5.2
	Renner					Great Plains ANG #1	Gasification 137 MMSCFD	4.7	4.7	4.7
	Renner		9.9	12.4	14.6	Great Plains ANG #2	Gasification 137 MMSCFD	0	2.5	4.7
Glenharold	Glenharold	Basin Electric	3.8	3.8	3.8	Leland Olds	Power Plant 655 MW	3.8	3.8	3.8
Velva	None	Consolidation Coal	0.3	0.3	0.3	Neal Plant	Power Plant 42 MW	0.3	0.3	0.3
Falkirk	Underwood	North American	5.6	5.6	5.6	Coal Creek	Power Plant 1000 MW	5.6	5.6	5.6
Gascoyne	None	Knife River	3.0	3.0	3.0	Big Stone, SD	Power Plant 415 MW	3.0	3.0	3.0
Husky	None	Husky Ind.	0.2	0.2	0.2	Briquetting Plant	Charcoal .15 MM Tons	0.2	0.2	0.2
Savage (MT)	None	Knife River	0.3	0.3	0.3	Lewis & Clark	Power Plant 47 MW	0.3	0.3	0.3
Center	Center	Baukol Noonan	4.1	4.1	4.1	Milton R. Young Square Butte	Power Plant 682 MW	4.1	4.1	4.1
Indianhead	North Beulah	North American	1.2	1.2	1.2	Stanton Power	Power Plant 172 MW	1.2	1.2	1.2
Preference Right Lease Application	North Fork		0.0	2.5	5.0	Unknown				
TOTAL			32.7	38.4	43.1			32.7	35.9	38.1

TABLE 1-4
Additional Baseline Information*

Employment**	4010
Water Use**	44.2 million gallons per day
Total Disturbance***	8,780 acres

*Totals estimated

**All baseline mines and facilities

***Acreage disturbance for the Gascoyne, Husky, Savage and Velva mines. For the other baseline mines and facilities, refer to Table 1-2.

Alternative 2—Leasing Below the Federal Leasing Target at 548.4 Million Tons

Alternative 2 was selected as an alternative containing recoverable coal for new production that is below the Secretary's leasing target. This alternative would make available 548.4 million tons of federal coal for new production and 203.2 million tons for production maintenance/by-pass, totaling 751.6 million tons of federal coal. The tracts selected by the RCT for this alternative are Bloomfield, South Wibaux-Beach, Dunn Center, Garrison, and Sakakawea, plus all of the production maintenance/by-pass tracts. These tracts are shown on Map 1 in Map Packet. Information related to these tracts and their potential development is included in Table 1-5. It is assumed that four conversion facilities would be associated with this alternative, which would consist of two gasification plants in Montana, one indirect liquefaction plant in North Dakota, and one electric power plant in North Dakota. The remaining tract, Sakakawea, is designed for small business and is located in North Dakota. The location of the facility for the South Wibaux-Beach tract is assumed to be in the NW1/4, Sec. 4, T13N, R60E of Wibaux County, Montana, and the location of the facility for the Garrison tract is assumed to be on the southeast corner of the tract. Also, the facility for the Garrison tract is one 400 megawatt electric power plant. The assumed location for the facility associated with the Dunn Center tract is in the N1/2, Sec. 12, T144N, R94W of Dunn County, North Dakota.

Alternative 3—Leasing Within the Federal Leasing Target at 827.2 Million Tons

The tracts selected for this alternative would provide recoverable coal for new production at the low end of the leasing target range of 0.8 to 1.2 billion tons established by the Secretary of the Interior. The production maintenance/by-pass tonnage (203.2 million tons) plus the new production tonnage (827.2 million tons) would make 1,030.4 million tons of federal coal available. Map 1 in the Map Packet shows the location of the tracts to be included in this alternative which are Burns Creek, Central Bloomfield, Circle West III, South Wibaux-Beach, Dunn Center, Garrison, Sakakawea, Truax, and Werner, plus all the production maintenance/by-pass tracts. Table 1-6 presents the pertinent information related to each tract in this alternative, and this alternative would provide the region with coal reserves for four electric power plants, one gasification plant, and three indirect liquefaction plants. Of the eight assumed facilities, one electric power plant, one gasification plant, and two indirect liquefaction plants would be associated with tracts in Montana and three electric power plants and one indirect liquefaction plant would be associated with tracts in North Dakota. Sakakawea is the small business tract located in North Dakota. The locations of the facilities are the same as in Alternative 2 or as assumed for the generic facility.

Alternative 4—Leasing Within the Federal Leasing Target at 853.9 Million Tons

To meet the needs of providing recoverable coal reserves for the Secretary's leasing target range of .8 to 1.2 billion tons of coal, the RCT selected this alternative near the low end of the target range. The total amount of federal coal made available by this alternative is 1,057.1 million tons which includes new production (853.9 million tons) and production maintenance/by-pass coal (203.2 million tons). Included in this alternative are the Burns Creek, Circle West III, South Wibaux-Beach, Dunn Center, Garrison, Sakakawea, Truax, Werner, and Zenith tracts, plus the production maintenance/by-pass tracts. The locations of these tracts are shown on Map 1 in the Map Packet and the information related to these tracts is summarized in Table 1-7. The nine new production tracts could provide the amount of coal necessary to meet the demands of eight conversion facilities, which include three indirect liquefaction plants, two gasification plants, and three electric power plants. These assumed facilities would be divided between the states with two indirect liquefaction plants and one gasification plant associated with tracts in Montana; and one indirect liquefaction plant, one gasification plant, and three electric power plants associated with tracts in North Dakota. The remaining tract, Sakakawea, is a small business tract located in North Dakota. The locations of the facilities are the same as described in Alternative 2 or as assumed for the generic facility.

TABLE 1-5
Alternative 2 — Leasing Below the Federal Leasing Target at 548.4 Million Tons

Tract	Facility Type	Annual Prod. (tons x 10^6)	Recoverable Reserves (tons x 10^6)				Tract Acreage				Mined Acreage				Other Disturbed Acres				
			Federal	State	Private	Total	Federal	State	Private	Total	Federal	State	Private	Total	Mine Facility	End-Use Facility	Roads/ Power Lines/ Pipelines	Total	Tot. Tract & Fac. Disturb.
Bloomfield	Gasification	14.0	135.9	41.9	242.7	420.5	4145	1240	7507	12892	3787	1125	6670	11582	160	960	137	1257	12839
South Wibaux-Beach	Gasification	14.0	122.6	4.2	456.3	583.1	3128	320	11450	14898	3073	141	10505	13719	160	960	205	1325	15044
Dunn Center	Indirect Liquefaction	14.1	270.5	52.7	239.0	562.2	8763	1730	10164	20657	8093	1626	8438	18157	160	960	218	1338	19495
Garrison	Electric Power	5.7	17.4	19.6	190.0	227.0	1380	1682	11449	14511	1234	1628	11315	14177	240	600	173	1013	15190
Sakakawea	Small Business	0.2	2.0	0.3	5.9	8.2	280	160	920	1360	239	71	684	994	40		36	76	1070
NEW PROD. TOTAL		48.0	548.4	118.7	1133.9	1801.0	17696	5132	41490	64318	16426	4591	37612	58629	760	3480	769	5009	63638
By-pass Tracts**	Existing Facility	33.9	203.2 150.9*	65.3 21.8*	1175.3	1616.5	15704 7872*	5158 1799*	77804	108337	11119 5871*	3613 1140*	61590	83333			1403	1403	84736
EXISTING & NEW PROD. TOTAL		81.9	751.6 150.9*	184.0 21.8*	2309.2	3417.5	33400 7872*	10290 1799*	119294	172655	27545 5871*	8204 1140*	99202	141962	760	3480	2172	6412	148374

Tract	Water needs (gallons/day)				Air Emission Rate (pounds per hour)			Employment				Anticipated Dates				Project Trans.	Direction of Trans. Fac.
	Mine		End Use Facility					Mine		Facility		Mine		Facility			
	Human Consump.	Non-Potable	Human Consump.	Non-Potable	Particulate	Sulfur Dioxide	Nitrogen Dioxide	Const	Oper	Const	Oper	Const	Oper	Const	Oper		
Bloomfield	15,000	120,000	30,000	11,000,000	575	4600	2800	265	450	2617	900	1988	1990	1988/1992	1991/1992	Pipeline	NE to N Border
South Wibaux-Beach	15,000	120,000	30,000	9,000,000	385	1591	1100	260	300	4000	1050	1986	1980	1990	1990	Pipeline	NE to N Border
Dunn Center	15,000	300,000	30,000	11,000,000	112	2600	4420	265	450	5750	1140	1985	1988	1989	1989	Pipeline	East
Garrison	7,000	60,000	7,000	12,000,000	150	2992	2256	125	135	930	70	1988	1990	1992	1992	Trans. Line	S.E.
Sakakawea	600	10,000						50	20								
NEW PROD. TOTAL	52,600	610,000	97,000	43,000,000				965	1355	13297	3160						
By-Pass Tracts**																	
EXISTING AND NEW PROD. TOTAL	52,600	610,000	97,000	43,000,000				965	1355	13297	3160						

*Currently leased.
**These figures represent continued operation of mines and facilities associated with the production maintenance/by-pass tracts. Acreage figures would be similar whether or not federal coal is leased. Only coal ownership would change appreciably. The figures do not reflect information on the Gascoyne, Husky, Savage, and Velva mines.

TABLE 1-6
Alternative 3 — Leasing Within the Federal Leasing Target of 827.2 Million Tons

Tract	Facility Type	Annual Prod. (tons x 10^6)	Recoverable Reserves (tons x 10^6)				Tract Acreage				Mined Acreage				Other Disturbed Acres				
			Federal	State	Private	Total	Federal	State	Private	Total	Federal	State	Private	Total	Mine Facility	End-Use Facility	Roads/ Power Lines/ Pipelines	Total	Tot. Tract & Fac. Disturb.
Burns Creek	Indirect Liquefaction	13.4	31.0 227.5*	11.2 90.9*	175.2	535.8	2152 4456*	1080 1800*	6842	16330	620 4228*	205 1695*	3285	10033	160	960	210	1330	11363
Central Bloomfield	Electric Power	6.5	105.1	13.7	141.5	260.3	3065	600	4547	8212	2992	485	3990	7467	160	600	135	895	8362
Circle West III	Indirect Liquefaction	13.0	174.6	37.8	249.3	461.7	7782	1840	11261	20883	6782	1590	9677	18049	160	960	212	1332	19381
South Wibaux-Beach	Gasification	14.0	122.6	4.2	456.3	583.1	3128	320	11450	14898	3073	141	10505	13719	160	960	205	1325	15044
Dunn Center	Indirect Liquefaction	14.1	270.5	52.7	239.0	562.2	8763	1730	10164	20657	8093	1626	8438	18157	160	960	218	1338	19495
Garrison	Electric Power	5.7	17.4	19.6	190.0	227.0	1380	1682	11449	14511	1234	1628	11315	14177	240	600	173	1013	15190
Sakakawea	Small Business	0.2	2.0	0.3	5.9	8.2	280	160	920	1360	239	71	684	994	40		36	76	1070
Truax	Electric Power	5.6	27.0	18.5	237.3	282.8	2073	1440	19947	23460	1812	1257	15696	18765	160	600	198	958	19723
Werner	Electric Power	5.6	77.0	19.9	128.8	225.7	3349	720	5508	9577	3349	720	5508	9577	160	600	112	872	10449
NEW PROD. TOTAL		78.1	827.2 227.5*	177.9 90.9*	1823.3	3146.8	31972 4456*	9572 1800*	82088	129888	28194 4228*	7723 1695*	69098	110938	1400	6240	1499	9139	120077
By-pass Tracts**	Existing Facility	33.9	203.2 150.9*	65.3 21.8*	1175.3	1616.5	15704 7872*	5158 1799*	77804	108337	11119 5871*	3613 1140*	61590	83333			1403	1403	84736
EXISTING AND NEW PROD. TOTAL		112.0	1030.4 378.4*	243.2 112.7*	2998.6	4763.3	47676 12328*	14730 3599*	159892	238225	39313 10099*	11336 2835*	130688	194271	1400	6240	2902	10542	204813

Tract	Water needs (gallons/day)				Air Emission Rate (pounds per hour)			Employment				Anticipated Dates				Project Trans.	Direction of Trans. Fac.
	Mine		End Use Facility					Mine		Facility		Mine		Facility			
	Human Consump.	Non-Potable	Human Consump.	Non-Potable	Particulate	Sulfur Dioxide	Nitrogen Dioxide	Const	Oper	Const	Oper	Const	Oper	Const	Oper		
Burns Creek	15,000	120,000	30,000	11,000,000	112	2600	4420	260	440	2617	900	1988	1990	1988/1992	1992/1997	Pipeline	East
Central Bloomfield	7,000	60,000	7,000	12,000,000	375	7530	5640	205	290	1248	200	1988	1990	1988/1992	1991/1995	Trans. Line	South
Circle West III	15,000	120,000	30,000	11,000,000	112	2600	4420	260	425	2617	900	1988	1990	1988/1992	1992/1997	Pipeline	S.E.
South Wibaux-Beach	15,000	120,000	30,000	9,000,000	385	1591	1100	260	300	4000	1050	1986	1989	1986	1990	Pipeline	NE to N Border
Dunn Center	15,000	300,000	30,000	11,000,000	112	2600	4420	265	450	5750	1140	1985	1988	1985	1989	Pipeline	East
Garrison	7,000	60,000	7,000	12,000,000	150	2992	2256	125	135	930	70	1988	1990	1988	1992	Trans. Line	S.E.
Sakakawea	600	10,000						50	20								
Truax	6,000	60,000	7,000	12,000,000	375	7530	5640	195	265	1248	200	1988	1990	1988/1992	1991/1995	Trans. Line	S.E.
Werner	7,000	120,000	7,000	12,000,000	375	7530	5640	205	290	1248	200	1988	1990	1988/1992	1991/1995	Trans. Line	East
NEW PROD. TOTAL	87,600	970,000	148,000	90,000,000				1825	2615	19658	4660						
By-Pass Tracts**																	
EXISTING AND NEW PROD. TOTAL	87,600	970,000	148,000	90,000,000				1825	2615	19658	4660						

*Currently leased.
**These figures represent continued operation of mines and facilities associated with the production maintenance/by-pass tracts. Acreage figures would be similar whether or not federal coal is leased. Only coal ownership would change appreciably. The figures do not reflect information on the Gascoyne, Husky, Savage and Velva mines.

TABLE 1-7
Alternative 4 — Leasing Within the Federal Leasing Target of 853.9 Million Tons

Tract	Facility Type	Annual Prod. (tons x 10^6)	Recoverable Reserves (tons x 10^6)				Tract Acreage				Mined Acreage				Other Disturbed Acres				
			Federal	State	Private	Total	Federal	State	Private	Total	Federal	State	Private	Total	Mine Facility	End-Use Facility	Roads/ Power Lines/ Pipelines	Total	Tot. Tract & Fac. Disturb.
Burns Creek	Indirect Liquifaction	13.4	31.0 227.5*	11.2 90.9*	175.2	535.8	2152 4456*	1080 1800*	6842	16330	620 4228*	205 1695*	3285	10033	160	960	210	1330	11363
Circle West III	Indirect Liquefaction	13.0	174.6	37.8	249.3	461.7	7782	1840	11261	20883	6782	1590	9677	18049	160	960	212	1332	19381
South Wibaux-Beach	Gasification	14.0	122.6	4.2	456.3	583.1	3128	320	11450	14898	3073	141	10505	13719	160	960	205	1325	15044
Dunn Center	Indirect Liquefaction	14.1	270.5	52.7	239.0	562.2	8763	1730	10164	20657	8093	1626	8438	18157	160	960	218	1338	19495
Garrison	Electric Power	5.7	17.4	19.6	190.0	227.0	1380	1682	11449	14511	1234	1628	11315	14177	240	600	173	1013	15190
Sakakawea	Small Business	0.2	2.0	0.3	5.9	8.2	280	160	920	1360	239	71	684	994	40		36	76	1070
Truax	Electric Power	5.6	27.0	18.5	237.3	282.8	2073	1440	19947	23460	1812	1257	15696	18765	160	600	198	958	19723
Werner	Electric Power	5.6	77.0	19.9	128.8	225.7	3349	720	5508	9577	3349	720	5508	9577	160	600	112	872	10449
Zenith	Gasification	13.5	131.8	54.9	300.0	486.7	4593	3600	10200	18393	4507	1763	11098	17368	160	960	177	1297	18665
NEW PROD. TOTAL		85.1	853.9 227.5*	219.1 90.9*	1981.8	3373.2	3500 4456*	12572 1800*	87741	140069	29709 4228*	9001 1695*	76206	120839	1400	6600	1541	9541	130380
By-pass Tracts**	Existing Facility	33.9	203.2 150.9*	65.3 21.8*	1175.3	1616.5	15704 7872*	5158 1799*	77804	10833	11119 5871*	3613 1140*	61590	83333			1403	1403	84736
EXISTING AND NEW PROD. TOTAL		119.0	1057.1 378.4*	284.4 112.7*	3157.1	4989.7	49204 12328*	17730 3599*	165545	24840	40828 10099*	12614 2835*	137796	204172	1400	6600	2944	10944	215116

Tract	Water needs (gallons/day)				Air Emission Rate (pounds per hour)			Employment				Anticipated Dates				Project Trans.	Direction of Trans. Fac.
	Mine		End Use Facility					Mine		Facility		Mine		Facility			
	Human Consump.	Non-Potable	Human Consump.	Non-Potable	Particulate	Sulfur Dioxide	Nitrogen Dioxide	Const	Oper	Const	Oper	Const	Oper	Const	Oper		
Burns Creek	15,000	120,000	30,000	11,000,000	112	2600	4420	260	440	2617	900	1988	1990	1988/1992	1992/1997	Pipeline	East
Circle West III	15,000	120,000	30,000	11,000,000	112	2600	4420	260	425	2617	900	1988	1990	1988/1992	1992/1997	Pipeline	S.E.
South Wibaux-Beach	15,000	120,000	30,000	9,000,000	385	1591	1100	260	300	4000	1050	1986	1989	1986	1990	Pipeline	NE to N Border
Dunn Center	15,000	300,000	30,000	11,000,000	112	2600	4420	265	450	5750	1140	1985	1988	1985	1989	Pipeline	East
Garrison	7,000	60,000	7,000	12,000,000	150	2992	2256	125	135	930	70	1988	1990	1988	1992	Trans. Line	S.E.
Sakakawea	600	10,000						50	20								
Truax	6,000	60,000	7,000	12,000,000	375	7530	5640	195	265	1248	200	1988	1990	1988/1992	1992/1995	Trans. Line	S.E.
Werner	7,000	120,000	7,000	12,000,000	375	7530	5640	205	290	1248	200	1988	1990	1988/1992	1992/1995	Trans. Line	East
Zenith	15,000	120,000	30,000	11,000,000	575	4600	2800	260	425	3057	900	1988	1990	1988/1992	1992/1995	Pipeline	NE to N Border
NEW PROD. TOTAL	95,600	1,030,000	171,000	89,000,000				1880	2750	21467	5360						
By-Pass Tracts**																	
EXISTING AND NEW PROD. TOTAL	95,600	1,030,000	171,000	89,000,000				1880	2750	21467	5360						

*Currently leased.
**These figures represent continued operation of mines and facilities associated with the production maintenance/by-pass tracts. Acreage figures would be similar whether or not federal coal is leased. Only coal ownership would change appreciably. The figures do not reflect information on the Gascoyne, Husky, Savage, and Velva mines.

Alternative 5—Leasing Within the Federal Leasing Target at 1,101.0 Million Tons

The RCT selected the tracts within this alternative to be at the high end of the leasing target range of 0.8 to 1.2 billion tons of coal. The total federal coal made available is 1,304.2 million tons for both new production (1,101.0 million tons) and production maintenance/by-pass production (203.2 million tons). This alternative, shown on Map 1 in the Map Packet, will include the Bloomfield, Burns Creek, Circle West III, South Wibaux-Beach, Redwater II, Dunn Center, Garrison, Sakakawea, Truax, Werner, and Zenith tracts. This array of tracts could provide enough coal to meet the demands for three gasification plants, three indirect liquefaction plants, and four electric power plants. Two gasification plants, two indirect liquefaction plants, and one electric power plant would be assumed to be associated with the Montana tracts, while one gasification plant, one indirect liquefaction plant, and three electric power plants would be assumed to be associated with tracts in North Dakota. The remaining tract, Sakakawea, is the small business tract located in North Dakota. Information related to these tracts and their associated facilities is provided in Table 1-8 and the locations of the facilities are the same as described in Alternative 2 or as assumed for the generic facility.

Alternative 6—Leasing All Federal Coal Under Consideration

This alternative provides the maximum leasing available for the Fort Union Region at 1,671.4 million tons of federal coal for new production and 203.2 million tons for production maintenance/by-pass tracts, totaling 1,874.6 million tons of federal coal. Except for the Circle West III and Central Bloomfield tracts, all of the other tracts, as shown on Map 1 in the Map Packet, are included in this alternative. These two tracts have been removed because they are parts of other tracts which are being considered in this alternative. The maximum leasing option provides the amount of coal needed to develop five gasification plants, three indirect liquefaction plants, and six electric power plants within the region. In this alternative, four gasification plants, two indirect liquefaction plants, and three electric power plants would be assumed with the Montana tracts, while one gasification plant, one indirect liquefaction plant, and three electric power plants would be assumed with the North Dakota tracts. The remaining tract, Sakakawea, is the small business tract located in North Dakota. Table 1-9 provides the information for each of the tracts considered in this alternative and the locations of the facilities are the same as in Alternative 2 or as assumed for the generic facility.

TABLE 1-8

Alternative 5 — Leasing Within the Federal Leasing Target at 1,101.0 Million Tons

Tract	Facility Type	Annual Prod. (tons x 10^6)	Recoverable Reserves (tons x 10^6)				Tract Acreage				Mined Acreage				Other Disturbed Acres				
			Federal	State	Private	Total	Federal	State	Private	Total	Federal	State	Private	Total	Mine Facility	End-Use Facility	Roads/ Power Lines/ Pipelines	Total	Tot. Tract & Fac. Disturb.
Bloomfield	Gasification	14.0	135.9	41.9	242.7	420.5	4145	1240	7507	12892	3787	1125	6670	11582	160	960	137	1257	12839
Burns Creek	Indirect Liquefaction	13.4	31.0 227.5*	11.2 90.9*	175.2	535.8	2152 4456*	1080 1800*	6842	16330	620 4228*	205 1695*	3285	10033	160	960	210	1330	11363
Circle West III	Indirect Liquefaction	13.0	174.6	37.8	249.3	461.7	7782	1840	11261	20883	6782	1590	9677	18049	160	960	212	1332	19381
Redwater II	Electric Power	7.2	111.2	29.7	146.0	286.9	7935	1840	10471	20246	6723	1716	8807	17246	160	600	230	990	18236
South Wibaux-Beach	Gasification	14.0	122.6	4.2	456.3	583.1	3128	320	11450	14898	3073	141	10505	13719	160	960	205	1325	15044
Dunn Center	Indirect Liquefaction	14.1	270.5	52.7	239.0	562.2	8763	1730	10164	20657	8093	1626	8438	18157	160	960	218	1338	19495
Garrison	Electric Power	5.7	17.4	19.6	190.0	227.0	1380	1682	11449	14511	1234	1628	11315	14177	240	600	173	1013	15190
Sakakawea	Small Business	0.2	2.0	0.3	5.9	8.2	280	160	920	1360	239	71	684	994	40		36	76	1070
Truax	Electric Power	5.6	27.0	18.5	237.3	282.8	2073	1440	19947	23460	1812	1257	15696	18765	160	600	198	958	19723
Werner	Electric Power	5.6	77.0	19.9	128.8	225.7	3349	720	5508	9577	3349	720	5508	9577	160	600	112	872	10449
Zenith	Gasification	13.5	131.8	54.9	300.0	486.7	4593	3600	10200	18393	4507	1763	11098	17368	160	960	177	1297	18665
NEW PROD. TOTAL		106.3	1101.0 227.5*	290.7 90.9*	2370.5	4080.6	5580 4456*	15652 1800*	105719	173207	40219 4228*	11842 1695*	91683	149667	1720	8160	1908	11788	161455
By-pass Tracts**	Existing Facility	33.9	203.2 150.9*	65.3 21.8*	1175.3	1616.5	15704 7872*	5158 1799*	77804	108337	11119 5871*	3613 1140*	61590	83333			1403	1403	84736
EXISTING AND NEW PROD. TOTAL		140.2	1304.2 378.4*	356.0 112.7*	3545.8	5697.1	61284 12328*	20810 3599*	183523	281544	51338 10099*	15455 2835*	153273	233000	1720	8160	3311	13191	246191

Continued on next page

TABLE 1-8 (cont.)

Tract	Water needs (gallons/day) Mine Human Consump.	Mine Non-Potable	End Use Facility Human Consump.	End Use Facility Non-Potable	Air Emission Rate (pounds per hour) Particulate	Sulfur Dioxide	Nitrogen Dioxide	Employment Mine Const	Mine Oper	Facility Const	Facility Oper	Anticipated Dates Mine Const	Mine Oper	Facility Const	Facility Oper	Project Trans.	Direction of Trans. Fac.
Bloomfield	15,000	120,000	30,000	11,000,000	575	4600	2800	265	450	2617	900	1988	1990	1988/1992	1992/1997	Pipeline	NE to N Border
Burns Creek	15,000	120,000	30,000	11,000,000	112	2600	4420	260	440	2617	900	1988	1990	1988/1992	1992/1997	Pipeline	East
Circle West III	15,000	120,000	30,000	11,000,000	112	2600	4420	260	425	2617	900	1988	1990	1988/1992	1992/1997	Pipeline	S.E.
Redwater II	9,000	60,000	7,000	12,000,000	375	7530	5640	210	300	1248	200	1988	1990	1988/1992	1991/1995	Trans. Line	South
South Wibaux-Beach	15,000	120,000	30,000	9,000,000	385	1591	1100	260	300	4000	1050	1986	1989	1986	1990	Pipeline	NE to N Border
Dunn Center	15,000	300,000	30,000	11,000,000	112	2600	4420	265	450	5750	1140	1985	1988	1985	1989	Pipeline	East
Garrison	7,000	60,000	7,000	12,000,000	150	2992	2256	125	135	930	70	1988	1990	1988	1992	Trans. Line	S.E.
Sakakawea	600	10,000						50	20								
Truax	6,000	60,000	7,000	12,000,000	375	7530	5640	195	265	1248	200	1988	1990	1988/1992	1991/1995	Trans. Line	S.E.
Werner	7,000	120,000	7,000	12,000,000	375	7530	5640	205	290	1248	200	1988	1990	1988/1992	1991/1995	Trans. Line	East
Zenith	15,000	120,000	30,000	11,000,000	575	4600	2800	260	425	3057	900	1988	1990	1988/1992	1991/1995	Pipeline	NE to N Border
NEW PROD. TOTAL	119,600	1,210,000	208,000	112,000,000				2355	3500	25332	6460						
By-Pass Tracts**																	
EXISTING AND NEW PROD. TOTAL	119,600	1,210,000	208,000	112,000,000				2355	3500	25332	6460						

*Currently leased.
**These figures represent continued operation of mines and facilities associated with the production maintenance/by-pass tracts. Acreage figures would be similar whether or not federal coal is leased. Only coal ownership would change appreciably. The figures do not reflect information on the Gascoyne, Husky, Savage, and Velva mines.

TABLE 1-9
Alternative 6 — Leasing All Federal Coal Under Consideration

Tract	Facility Type	Annual Prod. (tons x 10^6)	Recoverable Reserves (tons x 10^6)				Tract Acreage				Mined Acreage				Other Disturbed Acres				
			Federal	State	Private	Total	Federal	State	Private	Total	Federal	State	Private	Total	Mine Facility	End-Use Facility	Roads/ Power Lines/ Pipelines	Total	Tot. Tract & Fac. Disturb.
Bloomfield	Gasification	14.0	135.9	41.9	242.7	420.5	4145	1240	7507	12892	3787	1125	6670	11582	160	960	137	1257	12839
Burns Creek	Indirect Liquefaction	13.4	31.0 227.5*	11.2 90.9*	175.2	535.8	2152 4456*	1080 1800*	6842	16330	620 4228*	205 1695*	3285	10033	160	960	210	1330	11363
Circle West I	Electric Power	5.4	85.5	12.6	117.9	216.0	3589	640	5630	9859	3228	608	4474	8310	160	600	155	915	9225
Circle West II	Electric Power	6.1	89.1	25.2	131.4	245.7	4193	1200	5631	11024	3554	982	5203	9739	160	600	176	936	10675
North Wibaux-Beach	Gasification	13.8	194.7	23.3	336.1	554.1	6678	640	12137	19455	6632	640	11196	18468	160	960	230	1350	19818
Redwater I	Gasification	14.0	201.6	32.4	229.5	463.5	9475	1640	11671	22786	8651	1389	9816	19856	160	960	175	1295	21151
Redwater II	Electric Power	7.2	111.2	29.7	146.0	286.9	7935	1840	10471	20246	6723	1716	8807	17246	160	600	230	990	18236
South Wibaux-Beach	Gasification	14.0	122.6	4.2	456.3	583.1	3128	320	11450	14898	3073	141	10505	13719	160	960	205	1325	15044
Southwest Glendive	Indirect Liquefaction	14.0	174.1	10.2	231.0	415.3	7543	1040	12725	21308	7004	586	10391	17981	160	960	290	1410	19391
Dunn Center	Indirect Liquefaction	14.1	270.5	52.7	239.0	562.2	8763	1730	10164	20657	8093	1626	8438	18157	160	960	218	1338	19495
Garrison	Electric Power	5.7	17.4	19.6	19.0	227.0	1380	1682	11449	14511	1234	1628	11315	14177	240	600	173	1013	15190
Sakakawea	Small Business	0.2	2.0	0.3	5.9	8.2	280	160	920	1360	239	71	684	994	40		36	76	1070
Truax	Electric Power	5.6	27.0	18.5	237.3	282.8	2073	1440	19947	23460	1812	1257	15696	18765	160	600	198	958	19723
Werner	Electric Power	5.6	77.0	19.9	128.8	225.7	3349	720	5508	9577	3349	720	5508	9577	160	600	112	872	10449
Zenith	Gasification	13.5	131.8	54.9	300.0	486.7	4593	3600	10200	18393	4507	1763	11098	17368	160	960	177	1297	18665
NEW PROD. TOTAL		146.6	1671.4 227.5*	356.6 90.9*	3167.1	5513.5	69276 4456*	18972 1800*	142252	236756	62506 4228*	14457 1695*	123086	205972	2360	11280	2722	16362	222334
By-pass Tracts**	Existing Facility	33.9	203.2 150.9*	65.3 21.8*	1175.3	1616.5	15704 7872*	5158 1799*	77804	108337	11119 5871*	3613 1140*	61590	83333			1403	1403	84736
EXISTING AND NEW PROD. TOTAL		180.5	1874.6 378.4*	421.9 112.7*	4342.4	7130.0	84980 12328*	24130 3599*	220056	345093	73625 10099*	18070 2835*	184676	289305	2360	1128	4125	17765	307070

Continued on next page

TABLE 1-9 (cont.)

Tract	Water needs (gallons/day) Mine Human Consump.	Mine Non-Potable	End Use Facility Human Consump.	End Use Facility Non-Potable	Air Emission Rate (pounds per hour) Particulate	Sulfur Dioxide	Nitrogen Dioxide	Employment Mine Const	Mine Oper	Facility Const	Facility Oper	Anticipated Dates Mine Const	Mine Oper	Facility Const	Facility Oper	Project Trans.	Direction of Trans. Fac.
Bloomfield	15,000	120,000	30,000	11,000,000	575	4600	2800	265	450	2617	900	1988	1990	1988/1992	1992/1997	Pipeline	NE to N Border
Burns Creek	15,000	120,000	30,000	11,000,000	112	2600	4420	260	440	2617	900	1988	1990	1988/1992	1992/1997	Pipeline	East
Circle West I	6,000	50,000	7,000	12,000,000	375	7530	5640	260	270	1248	200	1988	1990	1988/1992	1991/1995	Trans. Line	South
Circle West II	6,000	60,000	7,000	12,000,000	375	7530	5640	205	290	1248	200	1988	1990	1988/1992	1991/1995	Trans. Line	South
North Wibaux-Beach	15,000	120,000	30,000	9,000,000	385	1591	1100	260	300	4000	1050	1986	1989	1986	1990	Pipeline	NE to N Border
Redwater I	15,000	120,000	30,000	11,000,000	375	4600	2800	265	450	2617	900	1991	1994	1990	1995	Pipeline	NE to N Border
Redwater II	9,000	60,000	7,000	12,000,000	375	7530	5640	210	300	1248	200	1988	1990	1988/1992	1991/1995	Trans. Line	South
South Wibaux-Beach	15,000	120,000	30,000	9,000,000	385	1591	1100	260	300	4000	1050	1986	1989	1986	1990	Pipeline	NE to N Border
Southwest Glendive	15,000	120,000	30,000	11,000,000	112	2600	4420	265	450	2617	900	1988	1990	1988/1992	1992/1997	Pipeline	West
Dunn Center	15,000	300,000	30,000	11,000,000	112	2600	4420	265	450	5750	1140	1985	1988	1985	1989	Pipeline	East
Garrison	7,000	60,000	7,000	12,000,000	150	2992	2256	125	135	930	70	1988	1990	1988	1992	Trans. Line	S.E.
Sakakawea	600	10,000						50	20								
Truax	6,000	60,000	7,000	12,000,000	375	7530	5640	195	265	1248	200	1988	1990	1988/1992	1991/1995	Trans. Line	S.E.
Werner	7,000	120,000	7,000	12,000,000	375	7530	5640	205	290	1248	200	1988	1990	1988/1992	1991/1995	Trans. Line	East
Zenith	15,000	120,000	30,000	11,000,000	575	4600	2800	260	425	3057	900	1988	1990	1988/1992	1991/1995	Pipeline	NE to N Border
NEW PROD. TOTAL	161,600	1,560,000	282,000	156,000,000				3350	4835	34445	8810						
By-Pass Tracts**																	
EXISTING & NEW PROD. TOTAL	161,600	1,560,000	282,000	156,000,000				3350	4835	34445	8810						

*Currently leased.
**These figures represent continued operation of mines and facilities associated with the production maintenance/by-pass tracts. Acreage figures would be similar whether or not federal coal is leased. Only coal ownership would change appreciably. The figures do not reflect information on the Gascoyne, Husky, Savage, and Velva mines.

WOODSON PREFERENCE RIGHT LEASE APPLICATION

This discussion addresses the regional implications that would occur in the Fort Union Coal Region in relation to Alternative 3 if the federal coal in the Preference Right Leasing Application (PRLA M-10195) was leased. Leasing of the coal in the PRLA would be non-competitive and therefore would not be included in the June 1983 coal sale. The decision whether or not to lease the PRLA coal must be made by December 1984.

A Preliminary Logical Mining Unit (PLMU) was designed for the PRLA in order to address the impacts of a mining operation. The boundary of the PLMU includes enough additional private and state-owned coal to bring the total recoverable coal reserves up to 244.5 million tons; enough to support a 1,000 megawatt power plant. The PLMU was named North Fork. Information for this analysis is presented in Table 1-10 and the relationship of the PRLA to the coal tracts in Alternative 3 is shown on Map 1 in the Map Packet. The Miles City District completed a separate analysis on the North Fork PLMU in March 1982.

The major action facing the BLM regarding the Woodson PRLA is simply the terms and conditions under which the coal would be leased to a private party. Competitive leasing, and therefore a choice of whether to lease or not in this area, is not an issue. Since it is assumed that the coal would be leased to the private sector under a preference right and be made available for development, coal tonnages and likely coal produc-

TABLE 1-10
Woodson PRLA

Tract	Facility Type	Annual Prod. (tons x 10^6)	Recoverable Reserves (tons x 10^6) Federal	State	Private	Total	Tract Acreage Federal	State	Private	Total	Mined Acreage Federal	State	Private	Total	Other Disturbed Acres: Mine Facility	End-Use Facility	Roads/ Power Lines/ Pipelines	Total	Tot. Tract & Fac. Disturb.
Burns Creek	Indirect Liquefaction	13.4	31.0 227.5*	11.2 90.9*	175.2	535.8	2152 4456*	1080 1800*	6842	16330	620 4228*	205 1605*	3285	10033	160	960	210	1330	11363
Central Bloomfield	Electric Power	6.5	105.1	13.7	141.5	260.3	3065	600	4547	8212	2992	485	3990	7467	160	600	135	895	8362
Circle West III	Indirect Liquefaction	13.0	174.6	37.8	249.3	461.7	7782	1840	11261	20883	6782	1590	9677	18049	160	960	212	1332	19381
South Wibaux-Beach	Gasification	14.0	122.6	4.2	456.3	583.1	3128	320	11450	14898	3073	141	10505	13719	160	960	205	1325	15044
Dunn Center	Indirect Liquefaction	14.1	270.5	52.7	239.0	562.2	8763	1730	10164	20657	8093	1626	8438	18157	160	960	218	1338	19495
Garrison	Electric Power	5.7	17.4	19.6	190.0	227.0	1380	1682	11449	14511	1234	1628	11315	14177	240	600	173	1013	15190
Sakakawea	Small Business	0.2	2.0	0.3	5.9	8.2	280	160	920	1360	239	71	684	994	40		36	76	1070
Truax	Electric Power	5.6	27.0	18.5	237.3	282.8	2073	1440	19947	23460	1812	1257	15696	18765	160	600	198	958	19723
Werner	Electric Power	5.6	77.0	19.9	128.8	225.7	3349	720	5508	9577	3349	720	5508	9577	160	600	112	872	10449
NEW PROD. TOTAL		78.1	827.2 227.5*	177.9 90.9*	1823.3	3146.8	31972 4456*	9572 1800*	82088	129888	28194 4228*	7723 1695*	69098	110938	1400	6240	1499	9139	120077
Woodson PRLA	Electric Power	6.1	73.5	10.4	160.6	244.5	2436	1200	3959	7595	1667	706	2822	5195	120	602	160	882	6077
SUBTOTAL		84.2	900.7 227.5*	188.3 90.9*	1983.9	3391.3	34408 4456*	10772 1800*	86047	137483	29861 4228*	8429 1695*	71920	116133	1520	6842	1659	10021	126154
By-Pass Tracts**	Existing Facilities	33.9	203.2 150.9*	65.3 21.8*	1175.3	1616.5	15704 7872*	5158 1799*	77804	108337	11119 5871*	3613 1140*	61590	83333			1403	1403	84736
EXISTING & NEW PRODUCTION TOTAL		118.1	1103.9 378.4*	253.6 112.7*	3159.2	35529.5	50112 12328*	15930 3599*	163851	245820	40980 10099*	12042 2835*	133510	199466	1520	6842	3062	11424	210890

Tract	Water needs (gallons/day) Mine: Human Consump.	Mine: Non-Potable	End Use Facility: Human Consump.	End Use Facility: Non-Potable	Air Emission Rate (pounds per hour): Particulate	Sulfur Dioxide	Nitrogen Dioxide	Employment Mine: Const	Mine: Oper	Facility: Const	Facility: Oper	Anticipated Dates Mine: Const	Mine: Oper	Facility: Const	Facility: Oper	Project Trans.	Direction of Trans. Fac.
Burns Creek	15,000	120,000	30,000	11,000,000	112	2600	4420	260	440	2617	900	1988	1990	1988/1992	1992/1997	Pipeline	East
Central Bloomfield	7,000	60,000	7,000	12,000,000	375	7530	5640	205	290	1248	200	1988	1990	1988/1992	1991/1995	Trans. Line	South
South Wibaux-Beach	15,000	120,000	30,000	11,000,000	112	2600	4420	260	425	2617	900	1988	1990	1988/1992	1992/1997	Pipeline	S.E.
Circle West III	15,000	120,000	30,000	9,000,000	385	1591	1100	260	300	4000	1050	1986	1989	1986	1990	Pipeline	NE to N. Border
Dunn Center	15,000	300,000	30,000	11,000,000	112	2600	4420	265	450	5750	1140	1985	1988	1985	1989	Pipeline	East
Garrison	7,000	60,000	7,000	12,000,000	150	2992	2256	125	135	930	70	1988	1998	1988	1992	Trans. Line	S.E.
Sakakawea	600	10,000						50	20								
Truax	6,000	60,000	7,000	12,000,000	375	7530	5640	195	265	1248	200	1988	1990	1988/1992	1991/1995	Trans. Line	S.E.
Werner	7,000	120,000	7,000	12,000,000	375	7530	5640	205	290	1248	200	1988	1990	1988/1992	1991/1995	Trans. Line	East
NEW PROD. TOTAL	87,600	970,000	148,000	90,000,000				1825	2615	19658	4660						
Woodson PRLA	6,000	50,000	7,000	12,000,000	375	7530	5640	100	200	1900	200	1988	1990			Trans. Line	
SUBTOTAL	93,600	1,020,000	155,000	102,000,000				1925	2815	21558	4860						
By-Pass Tracts**																	
EXISTING AND NEW PROD. TOTAL	93,600	1,020,000	155,000	102,000,000				1925	2815	21558	4860						

*Currently leased

**These figures represent continued operation of mines and facilities associated with the production maintenance/by-pass tracts. Acreage figures would be similar whether or not federal coal is leased. Only coal ownership would change appreciably. The figures do not reflect information on the Gascoyne, Husky, Savage, and Velva mines.

tion are included in the baseline production forecast for the region through 1995.

However, since it is questionable whether or not the coal in this PRLA is likely to be developed as it is with any of the tracts in the region, analysis assumptions for environmental impact did not automatically assume that a mine and a power plant would result from this PRLA. Baseline social, economic, and environmental conditions were consciously based on only those mine and plant operations with a firm authorization to proceed at the present time. The relationship between environmental impacts resulting from PRLA development and those from competitive leasing is analyzed in conjunction with Alternative 3. However, it should be clearly understood that the PRLA could be developed concurrent with any of the competitive leasing alternatives analyzed in this EIS. The additional environmental consequences of its development would be similar regardless of which alternative is selected for competitive leasing.

MERIDIAN LAND AND MINERAL COMPANY'S PROPOSED COAL EXCHANGE

The Meridian Land and Mineral Company, a wholly-owned subsidiary of Burlington Northern, Inc., proposed on November 2, 1981, an exchange of federal coal for Meridian coal in the Circle West deposit of McCone County, Montana. Because of the checkerboard Meridian and federal coal property rights, Meridian believes it would be advantageous to both parties to make the exchange which would establish two mining units within the deposit. The exchange proposal indicates that the exchange would result in two areas containing about 350 million tons of recoverable lignite each.

The RCT decided to have the Meridian exchange and its regional implications addressed in relation to Alternative 3. All of the tracts listed in Alternative 3 will be addressed with the exchange except the Circle West III tract. The discussion will include the eight other tracts plus the Meridian exchange area, assuming that one methanol facility as described below will be constructed on the northern half of the exchange area. A second part of the discussion will assume that two 85,000 barrel per day methanol facilities would be constructed, one on the northern part of the exchange area and one on the southern part of the exchange area. Information related to this option is presented in Table 1-11, and additional information related directly to the exchange proposal is provided in the following paragraphs.

Meridian proposes that Nelson Creek be the dividing line for the exchange. Meridian would then identify a tract north of Nelson Creek for their needs and the BLM would select Meridian coal lands south of the creek. It is possible that the selection could be reversed. Map 1 in the Map Packet shows the general area where the proposed exchange is desired and the relationship of the exchange to the other federal coal tracts. As a part of the exchange proposal, Meridian proposes only the exchange of coal rights, however, exchange of surface ownership would be considered if it is felt that it would be in the public interest.

The preliminary Circle West exchange block as defined by Meridian is comprised of three areas. The three areas are Meridian's proposed northeast and southwest additions and the Circle West III federal coal lease tract. The total acreage for these three areas is 70,390.

The mineral ownership in this area is predominately Meridian (49%) and federal (41%) with 10 percent state and private mineral ownership interspersed. The surface ownership of the area is 43 percent Meridian, including the Dreyer Brothers Ranch, 6 percent federal, 6 percent state, and 45 percent private. The majority of the private surface has been leased to Wesco Resources, Inc. Table 1-12 provides the breakdown of the mineral ownership in the proposed exchange area.

Communications with Meridian indicate a "first plant" or an initial plant capable of producing 2,500 tons (18,000 barrels/per day) of methanol. This rate of production would consume 2.6 million tons of lignite annually. Construction of this facility would require about 2,000 people maximum in the peak year and require an operational work force of about 200 people. The operation of the mine would require approximately 150 people. It would be expected that the facility could begin construction in 1987 and be operational by 1990. Water for the facility would come from Fort Peck Reservoir and amount to about 5,000 acre-feet per year.

It is assumed, however, that an indirect liquefaction plant producing 85,000 barrels of methanol could ultimately be developed in the northern part of the proposed exchange area. A description of the mine and methanol facility along with information for construction, operations, and employment are described in the Circle West III SSA and the Assumptions section of this chapter.

The discussion for the Meridian exchange proposal is divided into two parts. The first part will address the construction and development of an 18,000 barrel per day methanol facility with the associated mine followed with a discussion of the differences or additions in impact if that smaller facility is ultimately expanded to an 85,000 barrel per day facility (Figure 1-8).

The second part will discuss the regional implications of two indirect liquefaction projects producing 85,000 barrels per day of methanol each as described in the Circle West III SSA and the Assumption section of this chapter. Meridian's mine and facility would be in the northern part of the proposed exchange area and the second mine and facility would be in the southern part of the area (Figure 1-8).

TABLE 1-11
Meridian Proposed Coal Exchange

Tract	Facility Type	Annual Prod. (tons x 10^6)	Recoverable Reserves (tons x 10^6)				Tract Acreage				Mined Acreage				Other Disturbed Acres				
			Federal	State	Private	Total	Federal	State	Private	Total	Federal	State	Private	Total	Mine Facility	End-Use Facility	Roads/ Power Lines/ Pipelines	Total	Tot. Tract & Fac. Disturb.
Burns Creek	Indirect Liquefaction	13.4	31.0 227.5*	11.2 90.9*	175.2	535.8	2152 4456*	1080 1800*	6842	16330	620 4228*	205 1695*	3285	10033	160	960	210	1330	11363
Central Bloomfield	Electric Power	6.5	105.1	13.7	141.5	260.3	3065	600	4547	8212	2992	485	3990	7467	160	600	135	895	8362
South Wibaux-Beach	Gasification	14.0	122.6	4.2	456.3	583.1	3128	320	11450	14898	3073	141	10505	13719	160	960	205	1325	15044
Dunn Center	Indirect Liquefaction	14.1	270.5	52.7	239.0	562.2	8763	1730	10164	20657	8093	1626	8438	18157	160	960	218	1338	19495
Garrison	Electric Power	5.7	17.4	19.6	190.0	227.0	1380	1682	11449	14511	1234	1628	11315	14177	240	600	173	1013	15190
Sakakawea	Small Business	0.2	2.0	0.3	5.9	8.2	280	160	920	1360	239	71	684	994	40		36	76	1070
Truax	Electric Power	5.6	27.0	18.5	237.3	282.8	2073	1440	19947	23460	1812	1257	15696	18765	160	600	198	958	19723
Werner	Electric Power	5.6	77.0	19.9	128.8	225.7	3349	720	5508	9577	3349	720	5508	9577	160	600	112	872	10449
NEW PROD. TOTAL		65.1	652.6 227.5*	140.1 90.9*	1574.0	2685.1	24190 4456*	7732 1800*	70827	109005	21412 4228*	6133 1695*	59421	92889	1240	5280	1287	7807	100696
Meridian**	Indirect Liquefaction	26.0	410.7	73.2	517.6	1001.5	28607	5280	36503	70390	25011	4605	31475	61091	320	1920	424	2664	63845
SUBTOTAL		80.7	1063.3 227.5*	213.3 90.9*	2091.6	3686.6	52797 4456*	13012 1800*	107330	179395	46423 4228*	10738 1695*	90896	153980	1560	7200	1711	19471	164451
By-Pass Tracts***	Existing Facilities	33.9	203.2 150.9*	65.3 21.8*	1175.3	1616.5	15704 7872*	5158 1799*	77804	108337	11119 5871*	3613 1140*	61590	83333			1403	1403	84736
EXISTING AND NEW PROD. TOTAL		114.6	1266.5 378.4*	278.6 112.7*	3266.9	5303.1	68501 12328*	18170 3599*	185134	287732	57542 10099*	14351 2835*	152486	237313	1560	7200	3114	11874	249187

Tract	Water needs (gallons/day)				Air Emission Rate (pounds per hour)			Employment				Anticipated Dates				Project Trans.	Direction of Trans. Fac.
	Mine		End Use Facility					Mine		Facility		Mine		Facility			
	Human Consump.	Non-Potable	Human Consump.	Non-Potable	Particulate	Sulfur Dioxide	Nitrogen Dioxide	Const	Oper	Const	Oper	Const	Oper	Const	Oper		
Burns Creek	15,000	120,000	30,000	11,000,000	112	2600	4420	260	440	2617	900	1988	1990	1988/1992	1992/1997	Pipeline	East
Central Bloomfield	7,000	60,000	7,000	12,000,000	375	7530	5640	205	290	1248	200	1988	1990	1988/1992	1991/1995	Trans. Line	South
South Wibaux-Beach	15,000	120,000	30,000	9,000,000	385	1591	1100	260	300	4000	1050	1986	1989	1986	1990	Pipeline	NE to N. Border
Dunn Center	15,000	300,000	30,000	11,000,000	112	2600	4420	265	450	5750	1140	1985	1988	1985	1989	Pipeline	East
Garrison	7,000	60,000	7,000	12,000,000	150	2992	2256	125	135	930	70	1988	1998	1988	1992	Trans. Line	S.E.
Sakakawea	600	10,000						50	20								
Truax	6,000	60,000	7,000	12,000,000	375	7530	5640	195	265	1248	200	1988	1990	1988/1992	1991/1995	Trans. Line	S.E.
Werner	7,000	120,000	7,000	12,000,000	375	7530	5640	205	290	1248	200	1988	1990	1988/1992	1991/1995	Trans. Line	East
NEW PROD. TOTAL	72,600	650,000	118,000	79,000,000				1565	2190	17041	3760						
Meridian**	30,000	240,000	60,000	22,000,000	224	5200	8840	260	425	2617	900	1987	1990	1987/1990	1990/1994	Pipeline	S.E.
SUBTOTAL	102,600	1,090,000	178,000	101,000,000				2085	3040	22275	5560						
By-Pass Tracts***																	
EXISTING AND NEW PROD. TOTAL	102,600	1,090,000	178,000	101,000,000				2085	3040	22275	5560						

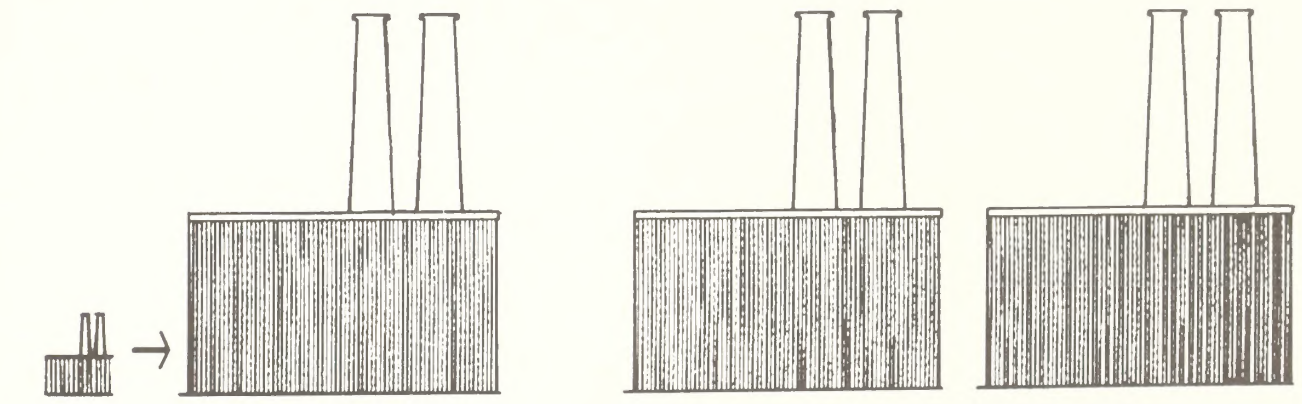
*Currently leased
**Information is for two 85,000 barrel per day methanol facilities, one north of Nelson Creek and one south.
***These figures represent continued operation of mines and facilities associated with the production maintenance/by-pass tracts. Acreage figures would be similar whether or not federal coal is leased. Only coal ownership would change appreciably. The figures do not reflect information on the Gascoyne, Husky, Savage, and Velva mines.

TABLE 1-12
Meridian Exchange Area
Mineral Ownership — Acres

	Meridian Mineral	GP* Mineral	Federal Mineral	State Mineral	Private Mineral	Totals
Meridian Surface	14,110	0	0	0	0	14,110
GP* Surface	5,087	3,479	6,837	0	0	15,403
Federal Surface	0	0	4,205	0	0	4,205
State Surface	0	0	38	4,720	0	4,758
Private Surface (Wesco Top-Lease)	8,718	0	9,941	0	747	19,406
Private Surface	3,251	0	7,586	560	1,111	12,508
Totals	31,166	3,479	28,607	5,280	1,858	70,390

*Glacier Park Company (a subsidiary of Burlington Northern).

FIGURE 1-8 MERIDIAN PROPOSED COAL EXCHANGE



COMPARISON OF ALTERNATIVES

The comparison of alternatives section presents those significant values which are particular to an alternative beyond the numerical progression of impacts discussed in Chapter 3. The comparison of alternatives figure (see Figure 1-9) gives the overall quantitative picture per alternative. The narrative discusses particular changes in impacts as they relate to other alternatives with accompanying figures in the alternative 2 discussion for impact reference.

Alternative 1

Alternative 1 consists of the production maintenance or by-pass tracts which are in North Dakota and their associated facilities (see Table 1-2) The total available new federal coal reserves is 203.2 million tons. There are no new facilities associated with the tracts. However, there are two facilities permitted and under construction.

Air Quality

The air quality analysis, while being completed through contract for distribution in August, includes the ambient air quality of the region and the permitted facilities which are all in North Dakota. The PSD Class I increment availability for the region is considered to be consumed at the present time.

Water Quality

The existing water demand is being met by available water sources with 45 to 162 water wells expected to be impacted through continued mining by the existing operations.

Agriculture

There would not be any additional agricultural disturbance, merely alternative areas being mined that would otherwise be bypassed in ongoing mining operations. No unique soils and agricultural production impacts were noted as opposed to comparable adjacent mine area acreages. Short-term soil disturbance would exceed acreage presently in summer fallow with indications that long term agricultural productivity could be restored.

Wildlife

Wildlife habitat would be affected to the extent that any loss would be detrimental to the wildlife population with the successful reclamation of wetlands, woody draws, and native prairie yet to be proved. This habitat would be impacted within the tract or adjoining the tracts with generally higher value habitat being associated with the federal coal tracts.

Cultural

The number and types of sites found in the tracts by and large should represent no obstacle to surface mining; however, there are sites in the Glenharold tract that have regionally significant values that may require special attention, preservation, or mitigation to preserve important and irreplaceable scientific information.

Other Land Use and Values

There would be minimal changes in the existing level of transportation use and development whether the tracts are leased or not. The rural/industrial character of the area would also be maintained with portions of the Schoolhouse and Center tracts being visible from a highway and town respectively.

Recreation

There would be a gradual increase in outdoor recreation demand with or without the leasing of the tracts. Community recreation land use demand would be expected to be stable with no additional needs as a result of the tracts being leased.

Economics

Economic conditions associated with mining the tracts would not generate any additional employment, fiscal payroll, or population change since the mines and facilities already exist. It is expected that these levels of economic activity would be maintained because of continued availability of jobs in the area.

Social

There should be no major changes in the social organization or social well being since the population should remain fairly stable with leasing of the tracts. The continued operation of the existing mines and facilities would require the continuing demand for the community services.

Alternative 2

Air Quality

It is expected that the air quality analysis would show that the PSD Class I increment would be consumed. The analysis will evaluate the cumulative effects of major pollutants as a result of the proposed actions within each alternative. This would include projected ground level concentrations of those pollutants as related to state and federal air quality standards and increments pertaining to the prevention of significant deterioration of air quality. Effects on visibility will also be analyzed.

FIGURE 1-9
COMPARISON OF ALTERNATIVES

Avail. of Fed. Coal Reserves(tons X 10^6)	1	2*	3*	4*	5*	6*	Woodson PRLA and Alternative 3*	Meridian Exchange and Alternative 3*
New Production	0	584.4	827.2	853.9	1,101.1	1,671.4	827.2	1,063.3
Total	203.2	751.6	1,030.4	1,057.1	1,304.2	1,874.6	1,103.9	1,266.5
Type of Development Likely	Existing Facility	7 Exist. Facilities 1 Small Business 1 Electric Power 1 Ind. Liquefaction 2 Gasification	7 Exist. Facilities 1 Small Business 4 Electric Power 3 Ind. Liquefaction 1 Gasification	7 Exist. Facilities 1 Small Business 3 Electric Power 3 Ind. Liquefaction 2 Gasification	7 Exist. Facilities 1 Small Business 4 Electric Power 3 Ind. Liquefaction 3 Gasification	7 Exist. Facilities 1 Small Business 6 Electric Power 3 Ind. Liquefaction 5 Gasification	7 Exist. Facilities 1 Small Business 7 Electric Power 3 Ind. Liquefaction 1 Gasification	7 Exist. Facilities 1 Small Business 4 Electric Power 5 Ind. Liquefaction 1 Gasification
Geographic Location of Tracts	7 ND	2 MT 10 ND	4 MT 12 ND	3 MT 13 ND	5 MT 13 ND	9 MT 13 ND	5 MT 12 ND	6 MT 12 ND
Tracts	Antelope Center Glenharold North Beulah Renner Schoolhouse Underwood	Bloomfield South Wibaux-Beach Dunn Center Garrison Sakakawea	Burns Creek Central Bloomfield Circle West III South Wibaux-Beach Dunn Center Garrison Sakakawea Truax Werner	Burns Creek Circle west III South Wibaux-Beach Dunn Center Garrison Sakakawea Truax Werner Zenith	Bloomfield Burns Creek Circle West III Redwater II South Wibaux-Beach Dunn Center Garrison Sakakawea Truax Werner Zenith	Bloomfield Burns Creek Circle west I Circle West II North Wibaux-Beach Redwater I Redwater II South Wibaux-Beach Southwest Glendive Dunn Center Garrison Sakakawea Truax Werner Zenith	Burns Creek Central Bloomfield Circle West III South Wibaux-Beach Dunn Center Garrison Sakakawea Truax Werner Woodson PRLA	Burns Creek Central Bloomfield South Wibaux-Beach Dunn Center Garrison Sakakawea Truax Werner Meridian (Full Prod.) BLM
Air Major comparison forthcoming in the Aug., 1982 report.	PSD Class I increment availability in question at present time.	Possible PSD Class I increment consumption (needs further modeling for positive analysis).	PSD Class I increment is being consumed by South Wibaux-Beach and possibly others.	Total PSD Class I increment consumption utilized by Zenith and South Wibaux-Beach.	Total PSD Class I increment utilized by Zenith and South Wibaux-Beach.	Zenith and both Wibaux-Beach facilities will utilize all PSD Class I increment.	Same as Alt.3	Same as Alt. 3
Water	45-162 wells Impacted	106-330 wells Impacted	171-458 wells Impacted	180-527 wells Impacted	216-563 wells Impacted.	347-734 wells Impacted.	196-483 wells Impacted.	233-520 wells Impacted.
Agriculture Croplands Rangelands (Removed from production during peak mining years)	5,164 Ac. 9,955 Ac.	7,007 - 9,014 Ac. 5,018 - 5,756 Ac.	9,294 - 11,075 Ac. 16,876 - 22,229 Ac.	10,675 - 12,072 Ac. 17,917 - 22,934 Ac.	13,272 - 16,012 Ac. 22,287 - 29,570 Ac.	19,599 - 25,590 Ac. 30,588 - 41,886 Ac.	9,307 - 11,095 Ac. 18,642 - 24,913 Ac.	9,539 - 11,447 Ac. 24,924 - 34,461 Ac.
Wildlife Woodlands Wetlands	5,417 Ac. 4,444 Ac.	11,455 Ac. 11,279 Ac.	12,119 Ac. 13,289 Ac.	12,977 Ac. 13,824 Ac.	12,043 Ac. 13,864 Ac.	13,095 Ac. 14,921 Ac.	12,358 Ac. 13,324 Ac.	12,314 Ac. 13,289 Ac.
Cultural Known Sites Potential Sites	119 427	234 766	276 1,016	272 1,056	292 1,185	326 1,463	282 1,046	299 1,544
Land Use and Transportation	4,800 $mi.^2$ Influenced	9,700 $mi.^2$ Influenced	8,800 $mi.^2$ Influenced	8,000 $mi.^2$ Influenced	9,400 $mi.^2$ Influenced	9,900 $mi.^2$ Influenced	No addition to #3.	No addition to #3.
Recreation Community (acres)	0	775.32	811.97	817.82	837.12	914.62	Same as Alt. 3	Same as Alt. 3
Economic Conditions	No additional impacts beyond existing condition.	Peak emp. 9,000; 6 MT cities, 8 ND cities	Peak emp. 15,000 (67% increase); 3 MT cities, 1 ND city. Impacts added	Peak emp. 16,800 (28% increase) 0 MT additional 2 ND additional Impacts added	Peak emp. 21,500 (28% increase) 0 MT additional 0 ND additional Impacts added	Peak emp. 29,200 (36% increase) 0 MT additional 0 ND additional Impacts added	Peak emp. 16,900 (12% increase) than #3 Impacts added	Peak emp. 17,600 (17% increase) than #3 Impacts added
Social Conditions	No additional impacts beyond existing condition	Teacher needs at peak population level - 918	Teacher needs at peak population level - 978	Teacher needs at peak population level - 1002	Teacher needs at peak population level - 1076	Teacher needs at peak population level - 1346	Teacher needs at peak population level - approx. 1095	Teacher needs at peak population level - approx. 1144

*Includes Alternative 1 tracts/impacts

Water Quality

Degradation of water well quality is expected to occur for all the wells projected to be impacted in each alternative (see Figures 1-10 and 1-11). The Dunn Center tract may be reduced, although not significantly, to protect the Spring Creek alluvial valley floor and the groundwater supply. Although there is enough water within the region to satisfy both industry and increased community needs, there is a problem with the lack of distribution systems for some communities. Dickinson is outgrowing its surface water supply and will have to develop additional supply and storage.

Agriculture

The short term soil disturbance by mining would somewhat exceed acreage presently in summer fallow. Long term productivity can be restored. Individual operators may be severely impacted with compensation exceeding considerable losses in agricultural income. Operators that have only leased land within the tracts would not be compensated. Regional crop production losses during peak mining years amount to less than one percent of those counties encompassing Alternative 2 tracts (see Figures 1-12 and 1-13). These losses are about one percent for Altemative 5 and 1.6 percent for Alternative 6. The agricultural support economy would not be affected. The regional impacts of this alternative are miniscule. These impacts are the same for Alternatives 3 through 6, the Woodson PRLA, and the Meridian exchange proposal.

Wildlife

Wildlife impacts would exist in the destruction of habitat (wetlands, woody draws, and native prairie, see Figure 1-12) and through disturbance from increased human population. The impacts would become more severe as more coal is mined and habitat destroyed. The cumulative impacts from this alternative through Alternative 6 are such that by Alternative 6 the wildlife resource as it is now known would be substantially altered.

Cultural

The Knife River Flint Quarries adjacent to and within the Dunn Center tract contain important and irreplaceable cultural information. Special tract stipulations discussed in Chapter 1 would help mitigate the significant impacts. The Dunn Center tract is in Altemative 2 through 6. The number and type of sites for all the

FIGURE 1-10 RANGE OF WATER WELLS IMPACTED

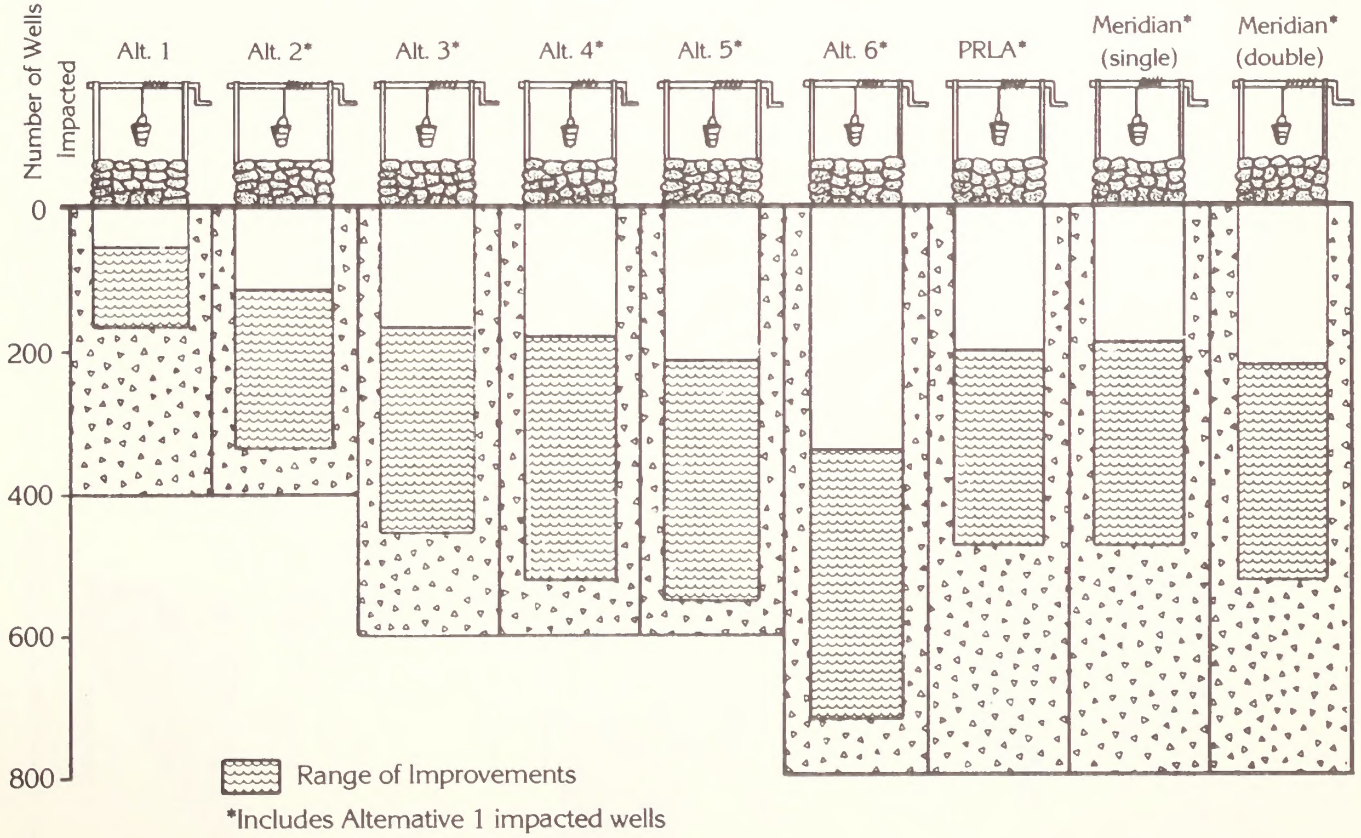
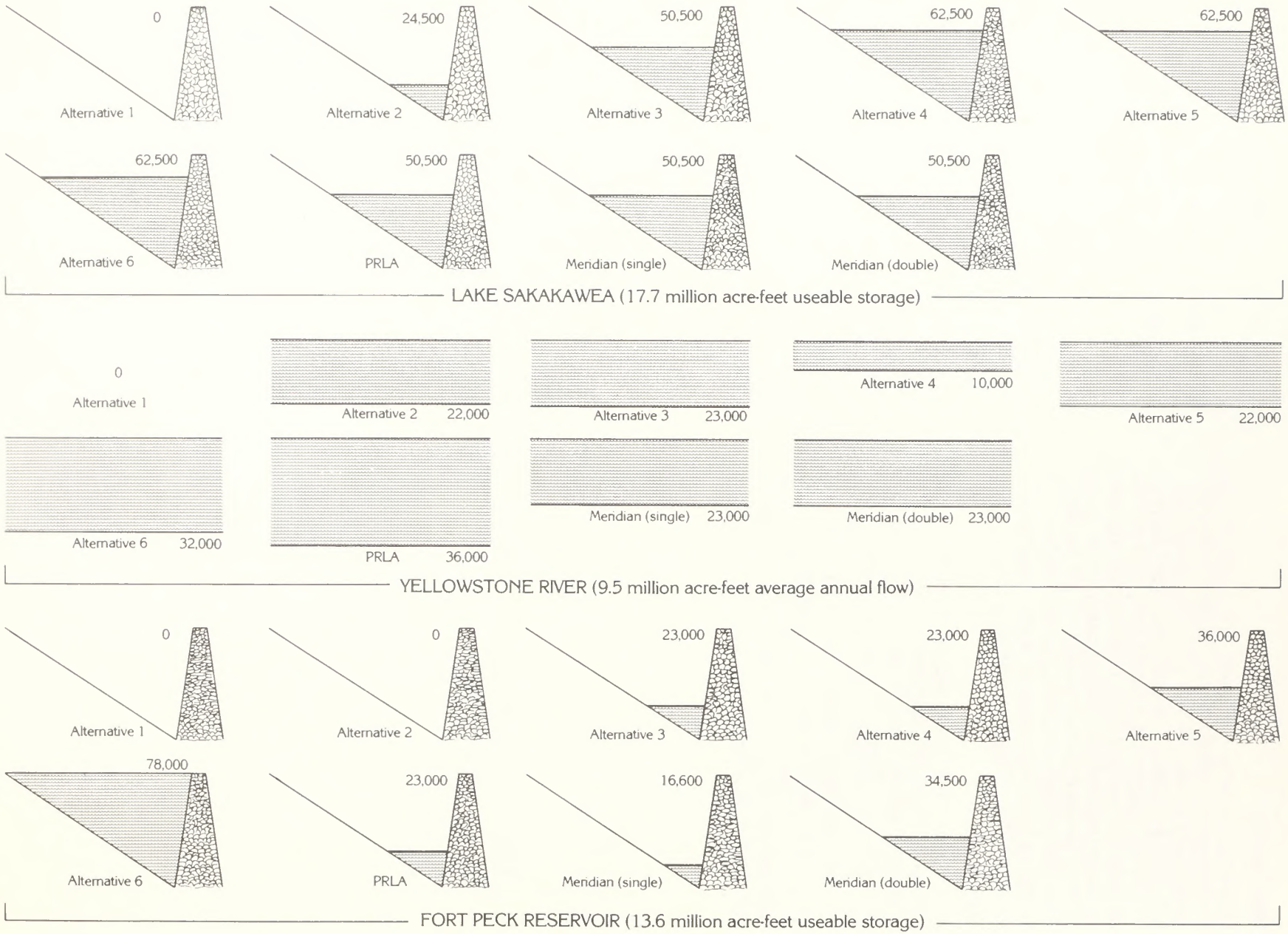
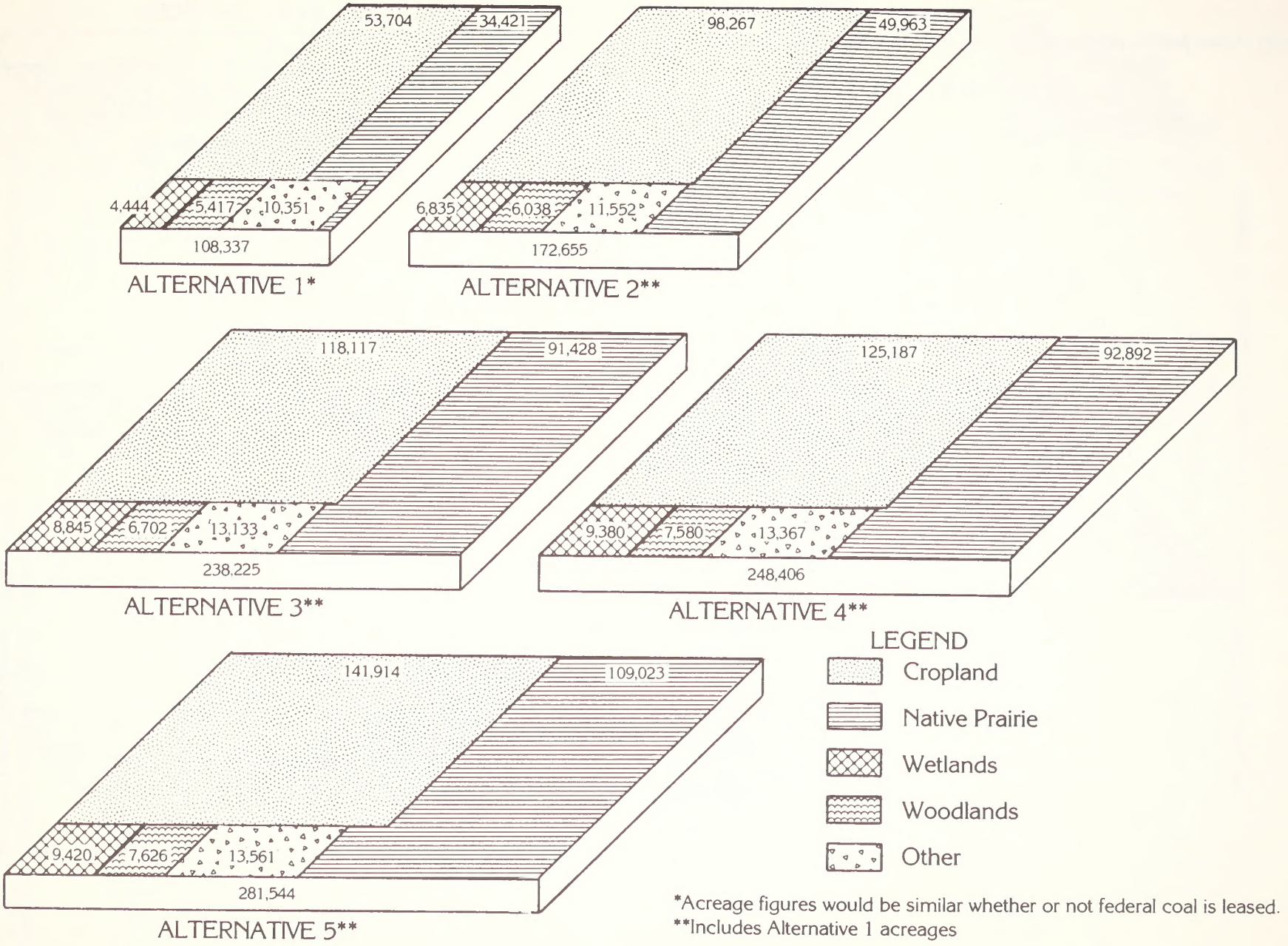


FIGURE 1-11 NEW WATER REQUIREMENTS FROM VARIOUS SOURCES (acre-feet/year)

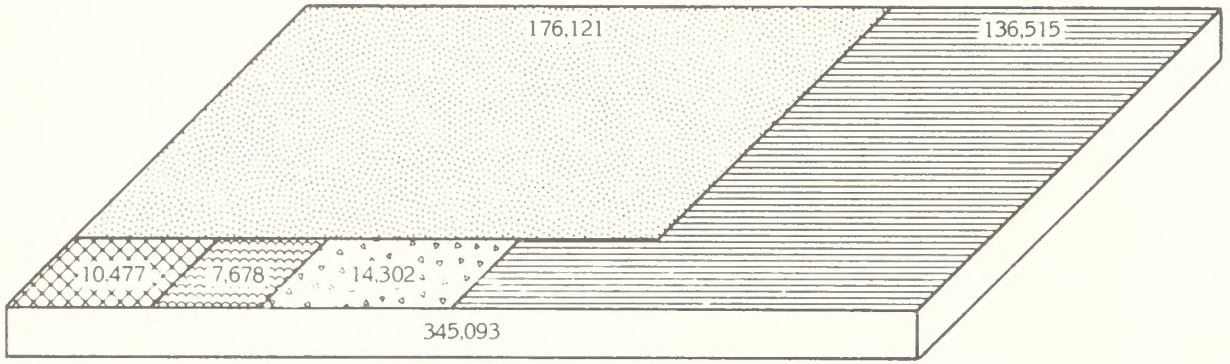




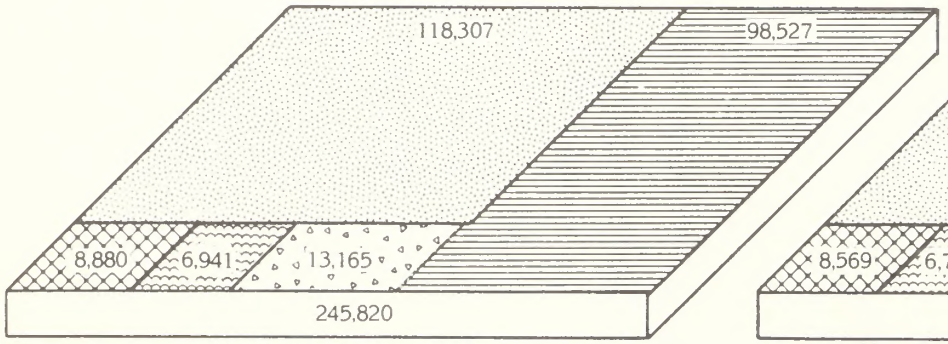
*Acreage figures would be similar whether or not federal coal is leased.
**Includes Alternative 1 acreages

FIGURE 1-12 VEGETATION TYPES IMPACTED (ACRES)

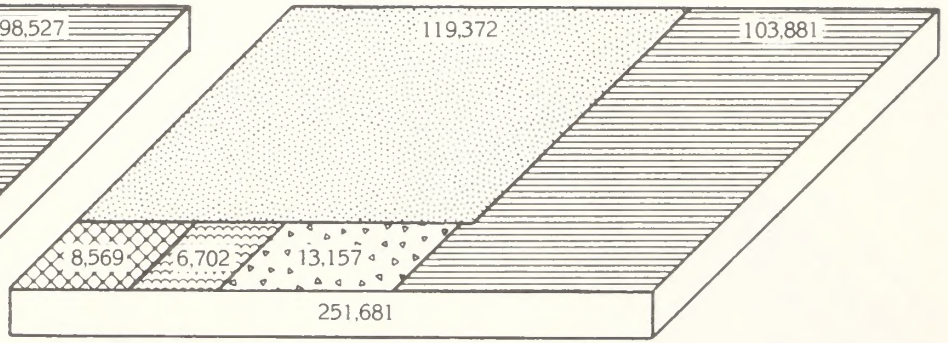
FIGURE 1-12 VEGETATION TYPES IMPACTED (ACRES) (Continued)



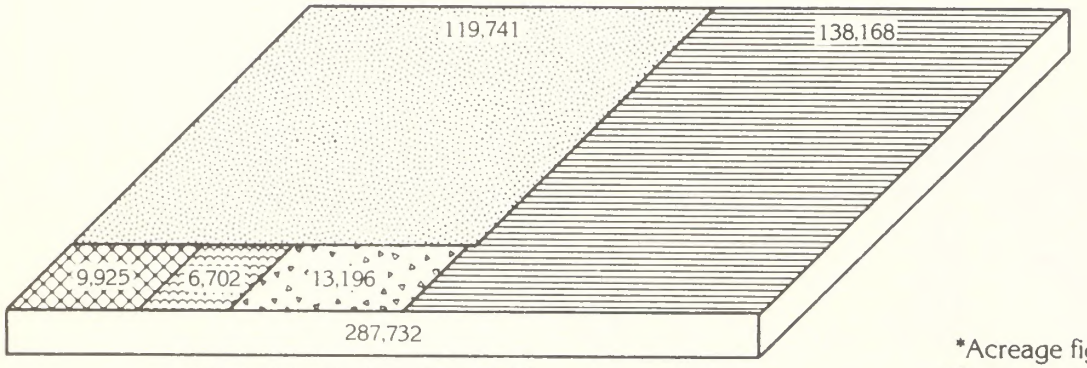
ALTERNATIVE 6**



WOODSON PRLA**



MERIDIAN (SINGLE)**



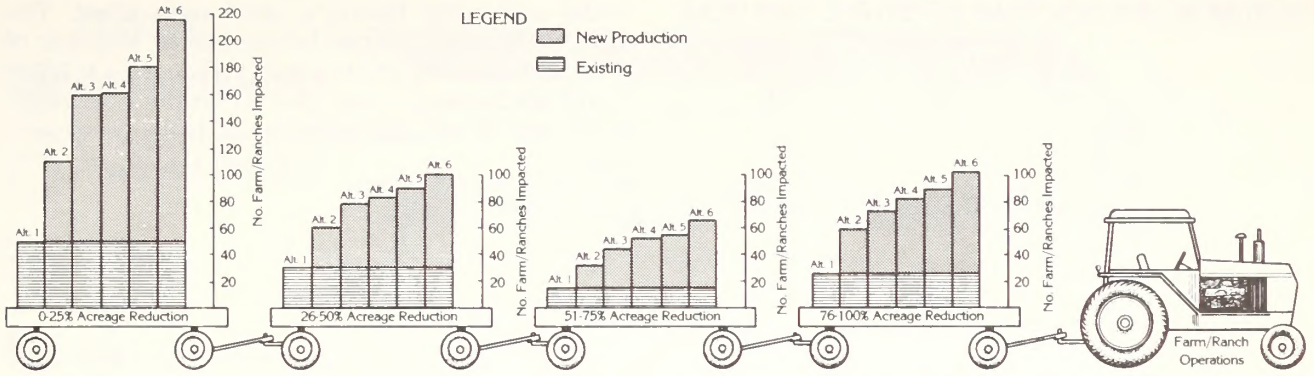
MERIDIAN (DOUBLE)**

LEGEND

- Cropland
- Native Prairie
- Wetlands
- Woodlands
- Other

*Acreage figures would be similar whether or not federal coal is leased.
**Includes Alternative 1 acreages

FIGURE 1-13 IMPACT ON FARM/RANCH OPERATIONS BY ACREAGE REDUCTION



alternatives including the Woodson PRLA and the Meridian exchange proposal should present no obstacle to surface mining (see Figure 1-14).

Other Land Uses and Values

The development of coal would result in the displacement of agricultural land. This land would be primarily rangeland in Montana and cropland in North Dakota. This impact would gradually change the character of the land and would generally consist of a numerical progression from this alternative through Alternative 6 (see Figure 1-15).

This increase in transportation needs would not exceed the capacity of the existing road system.

FIGURE 1-14 IMPACTED CULTURAL SITES

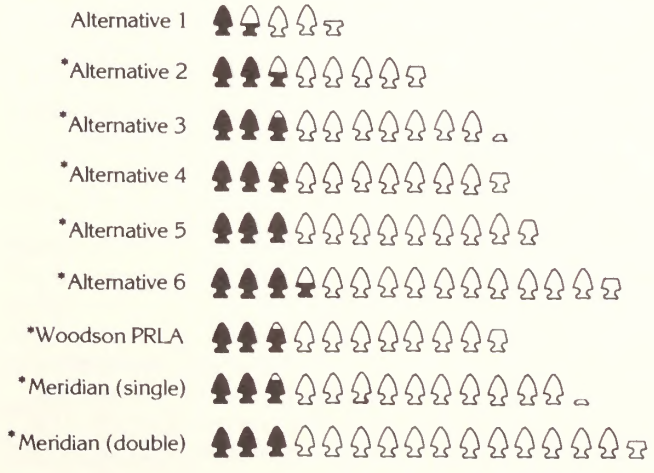
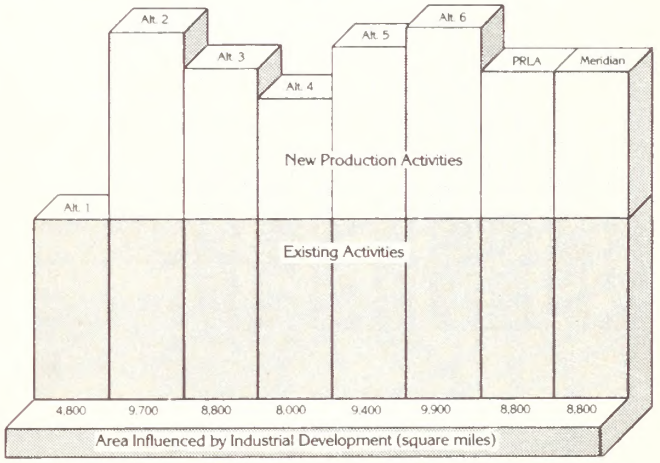


FIGURE 1-15 AREA INFLUENCED BY INDUSTRIAL DEVELOPMENT (Square Miles)



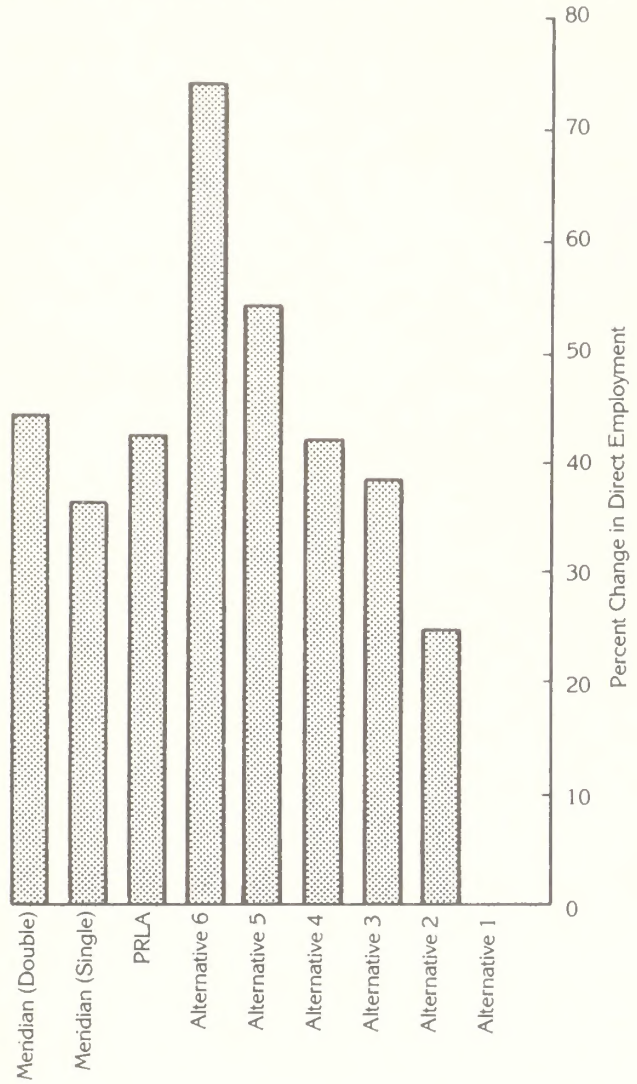
Recreation

The outdoor recreation demand would increase in eastern Montana. The increase in demand would be commensurate to the population increase for all alternatives. The problems that would be observed are increased landowner/recreationist conflicts and more congested user access at Fort Peck Reservoir. Community recreational land requirements may be increased as the population increases with each alternative. It is expected that there would be an increase in community land and facility availability as recreational planning would be included in planning other community services.

Economics

There would be a significant population influx as people move into the area to obtain jobs (see Figure 1-16). This alternative would result in impacts to the communites

FIGURE 1-16 CHANGE IN DIRECT EMPLOYMENT FROM BASELINE FOR PEAK CONSTRUCTION YEAR



of Glendive, Sidney, Bloomfield, Circle, and Wibaux, Montana, and Zap, Dunn Center, Halliday, Killdeer, Garrison, Sentinel Butte, Beulah, and Beach, North Dakota. Inflationary pressures would be felt in local communities as the demand for goods and services increased. Communities which are forecasted to experience fiscal deficits could have problems in providing adequate service levels.

Social

North Dakota communities affected most will be those in Dunn, Golden Valley, and Billings counties and the communities of Hazen and Zap in Mercer County and Garrison in McLean County. Montana communities receiving most of the impacts to social organization and well being are Glendive, Richey, and Bloomfield in Dawson County. The overall impacts will be substantial, permanent, and intensive to the social organization with social well being having a short term affect. The demand for teachers can be used as an indicator of professional needs and is shown in Figure 1-17. There would not be any impacts on the Fort Berthold Indian Reservation in this alternative or in subsequent alternatives.

Alternative 3

Water Quality

The impacts on the water resource will generally be the same as previously discussed; Fort Peck Reservoir would be added as a facility water source.

Other Land Uses and Values

Use would possibly stress state route 22 from Dickinson to the Dunn Center and Werner tracts. State route 200 near Hazen would also receive stress from the Stanton area.

Economics

Additional economic impacts would be experienced in Halliday, Dunn Center, Hazen, Zap, Circle, Terry, Sidney, Lambert, Jordan, and especially Glendive. Severe public service funding problems could be faced by these communities as they experience rapid, development-related population increases.

Social

The communities of Circle, Jordan, Terry, Lambert, Wolf Point, and Sidney, Montana, will receive accelerated impacts to their social organization. Hazen, Dunn Center, Bloomfield, Richey, and Glendive would receive a rapid influx of the peak workforce, which could result in severely handicapping the ability of the community to respond. Killdeer, Halliday, Circle, and Sidney would be required to plan for two peak construction periods with the prolonging of the short term chaotic construction period.

Alternative 4

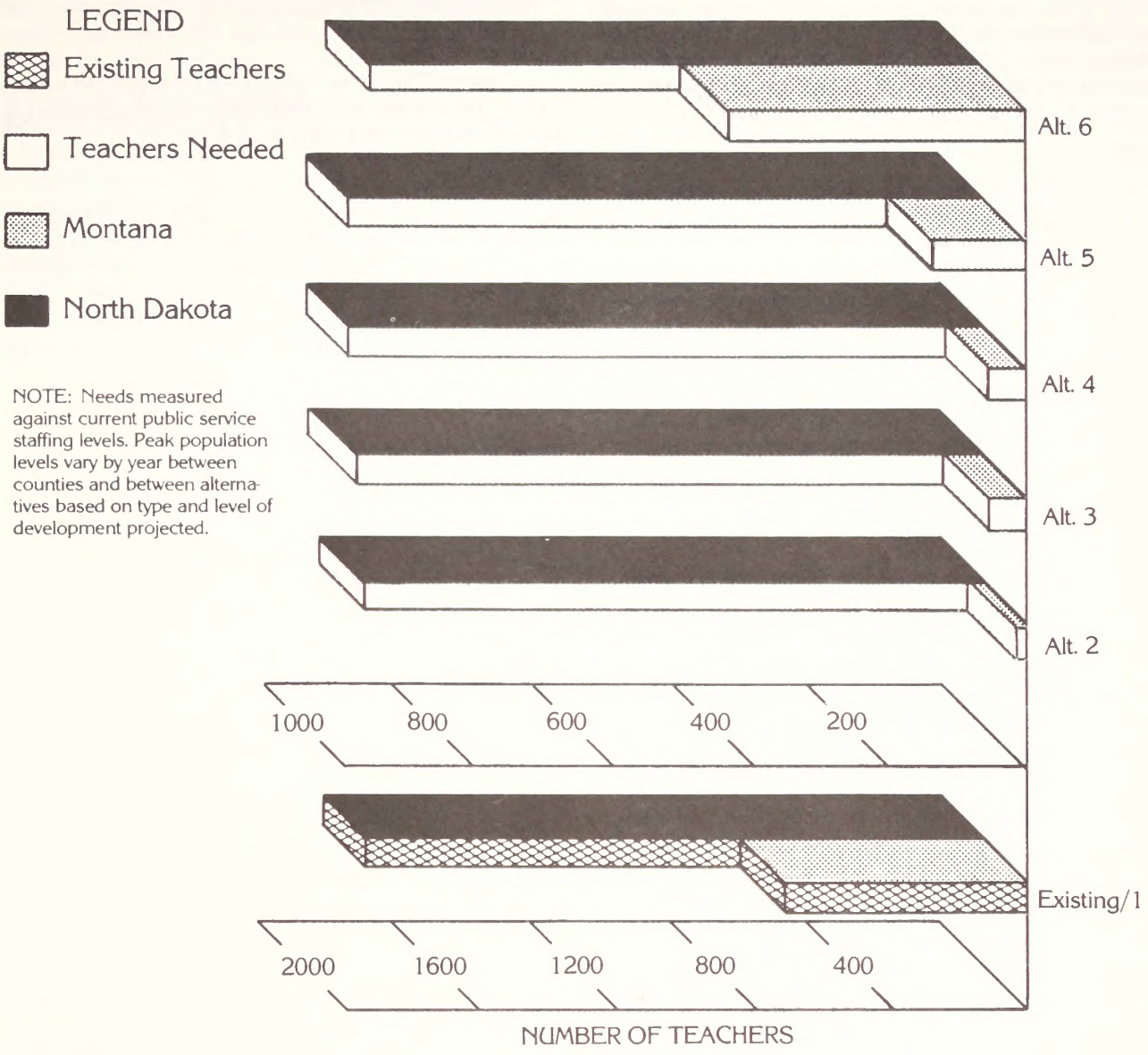
Water Quality

In the Zenith tract area, mining will cause degradation of subsurface and surface water along the Heart River. This tract is also included in Alternatives 5 and 6. The water quality of Patterson Lake, near Dickinson, will also be degraded.

Other Land Uses and Values

The capacity of the existing road system is unlikely to be exceeded except as noted in Alternative 2.

FIGURE 1-17 TEACHER NEEDS AT PEAK CONSTRUCTION POPULATION LEVELS



Economics

Additional economic impacts would be experienced by those communities previously mentioned with the addition of Dickinson and Belfield. Problems expected with rapid population growth and stress on community services are similar to preceeding alternatives.

Social

Dickinson and Belfield would experience major disruptions in the social organization and social well being. Glendive would receive a much lower peak construction workforce than in the previous alternative with similar reductions in the workforce in Bloomfield and Richey.

Alternative 5

Water Quality

Mining the Redwater II tract would completely destroy a portion of the Redwater River valley. Downstream irrigation would be degraded in quality and possibly quantity of water available. This tract is included in Alternative 6.

Other Land Uses and Values

The two mile segment of state route 16 between Glendive and state route 264 may be congested during rush hour traffic. Other routes would have impacts as discussed in Alternative 2.

Economics

The addition of more tracts adds significant population to the region. Circle and Richey would receive additional impacts over and above those impacts discussed in previous alternatives.

Social

Circle, Bloomfield, Richey, Glendive, and Sidney would receive intense and permanent changes in their social organization and well being.

Alternative 6

Water Quality

The inclusion of the Redwater I tract would further impact the Redwater River valley as discussed in Alternative 5. The town of Circle, Montana, may be forced to switch from groundwater to surface water or a combination of both for a municipal water supply.

Other Land Uses and Values

The road system from the North Wibaux-Beach tract would have to be monitored as access in this tract vicinity is not oriented towards the population centers impacted by this tract.

Economics

A dramatic increase in population would result in additional economic impacts to the communities of Lindsay, Terry, and especially, the towns of Circle, Wibaux, Beach, and Glendive over and above those in previous alternatives.

Social

Bloomfield would experience a smaller population influx than the previous alternative. Sidney, Savage, and Terry would receive higher population influxes than under the preceeding alternative. Beach, Sentinel Butte, Circle, Glendive, and Wibaux would experience very rapid population increases which would dramatically overwhelm the present social environment and quickly saturate the existing service and facility capacities.

Woodson PRLA

Economics

Somewhat greater economic and population impacts than those experienced in Alternative 3 would be felt in Sidney, Glendive, Savage, and Richey.

Social

The population influx would slightly increase the intensity of social impacts in Sidney, Glendive, Savage, and Richey and aggravate the temporary strains on community facilities and services.

Meridian Exchange

Water Quality

The town of Circle, Montana, may be forced to switch from groundwater to surface water or a combination of both for a municipal water supply.

Economics

The inclusion of a small synfuel plant with this proposal in Alternative 3 would result in a somewhat lower population influx into the area. Circle, Richey, and Jordan would receive lower population impacts. Two synfuel plants would result in proportionally larger population impacts with higher forecasted deficits on these same communities.

Social

Impacts would vary under the different exchange segments; however, significant impacts would occur in Circle, Glendive, Richey, and Jordan if both full-sized synfuel plants were constructed.

REGIONAL COAL TEAM PREFERRED ALTERNATIVE

By a three-two vote of the Fort Union Coal Team at its meeting on May 26, 1982, the RCT selected Alternative 3 as its preferred alternative. Alternative 3, with the minor modification noted below, would result in leasing an estimated 832.8 million tons of federal coal for new production.

Because of a refusal to consent to leasing filed within the Central Bloomfield tract, the Bloomfield tract was substituted in the preferred alternative. Since the total coal remaining after the refusal (approximately 395.3 million tons including all ownership) would likely eliminate synthetic fuel development as originally assumed for the Bloomfield tract, the analysis for the Bloomfield tract remains essentially the same as the Central Bloomfield tract which currently appears in the analysis of Alternative 3. In either case, power plant development would be assumed if the tract were leased and developed. The preferred alternative designated by the RCT also includes the leasing of by-pass tracts (203.2 million tons of federal coal) for a total lease sale involving 1036 million tons of federal coal. The preferred alternative would also have unleased state coal being made available for sale concurrently with the federal lease sale.

In arriving at this decision, the RCT made clear that Alternative 3 constituted a preferred alternative at this point based on knowledge to date and the preliminary analysis presented by project staff personnel. The RCT

was open minded on the issue regarding their final recommendation to the Secretary of the Interior scheduled for January 1983, and was still looking for public input prior to that time.

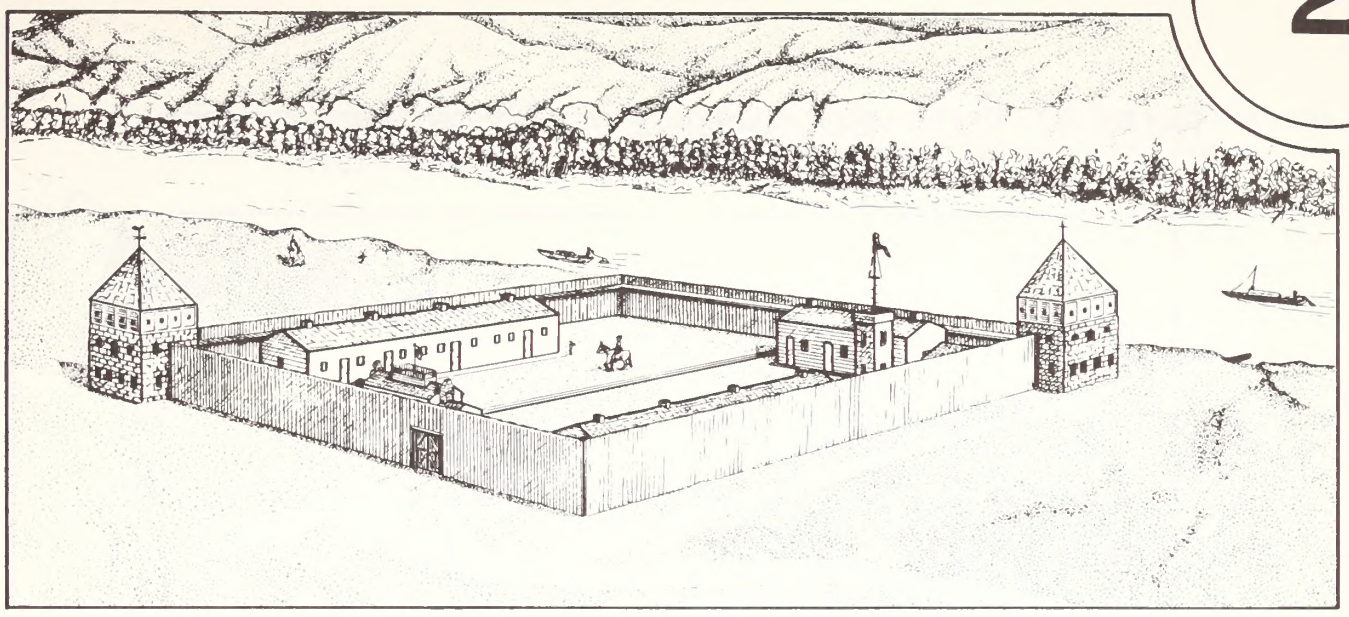
The Redwater tracts, Southwest Glendive tract, North Wibaux-Beach tract, and Zenith tract are not included in the preferred alternative. The RCT asked on several occasions at their May 26 meeting for rationale or interest in seeing these tracts included in the 1983 lease sale. Only in the Redwater tracts was any interest expressed. Given the low desirability ranking for leasing and development of the two Redwater tracts and the regional configuration of leasing, the RCT declined to add either of the Redwater tracts to its preferred alternative.

The Governor of Montana's representative noted that his vote against the preferred alternative was in part because of an apparent lack of serious industry interest, competitive or otherwise, in leasing and development of either Bloomfield or Burns Creek tracts at this time.

It should be added that the preferred alternative indicated here is that of the RCT, and is not necessarily that of the Secretary, nor does it bind the Secretary in any way in reaching a final federal leasing decision.

The impacts associated with leasing and development under the preferred alternative are essentially the same as those discussed in the draft EIS for Alternative 3.

CHAPTER 2



AFFECTED ENVIRONMENT

The discussion which follows has been guided by the major issues identified to date through public comment and local, state and other federal agency concerns. These issues have been used in tract ranking and the preparation of the alternatives by the Regional Coal Team. Other resources, while not identified as critical issues, have been included for general public information. These resources are land use, aesthetics, and recreation.

AIR QUALITY

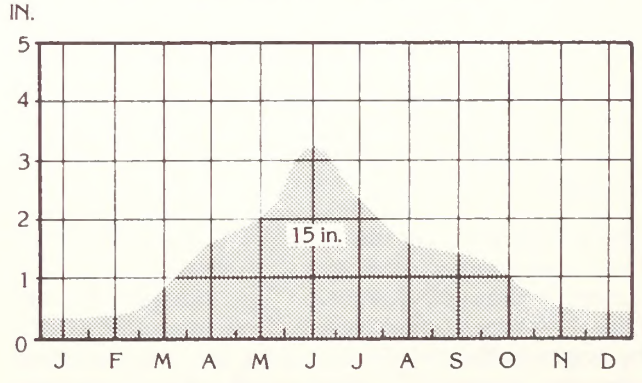
Climate and Meteorology

The Fort Union Coal Region of eastern Montana and western North Dakota is characterized by a semi-arid continental climate. Air masses which cross the region originate in the Arctic, the Gulf of Mexico, and the Northern Pacific. The Rocky Mountains, to the west of the region, modify the prevailing westerly flow of air masses from the Northern Pacific. There are no topographical barriers, however, to modify the flow of cold, dry air masses from the polar regions to the north and the warm, moist air masses from the tropical regions to the south. There are no distinct major air basins within the Fort Union region as a whole, and as a result there are often rapid changes in weather patterns over the Fort Union area.

The Fort Union area is a region of climatic extremes where temperatures vary widely on an annual, seasonal, and daily basis. Annual mean temperatures throughout the region range from about 39°F in Minot to about 46°F in Miles City. The highest monthly mean temperatures occur in July (about 70° to 75°F), and the lowest monthly mean temperatures (about 8-15°F) are recorded in January.

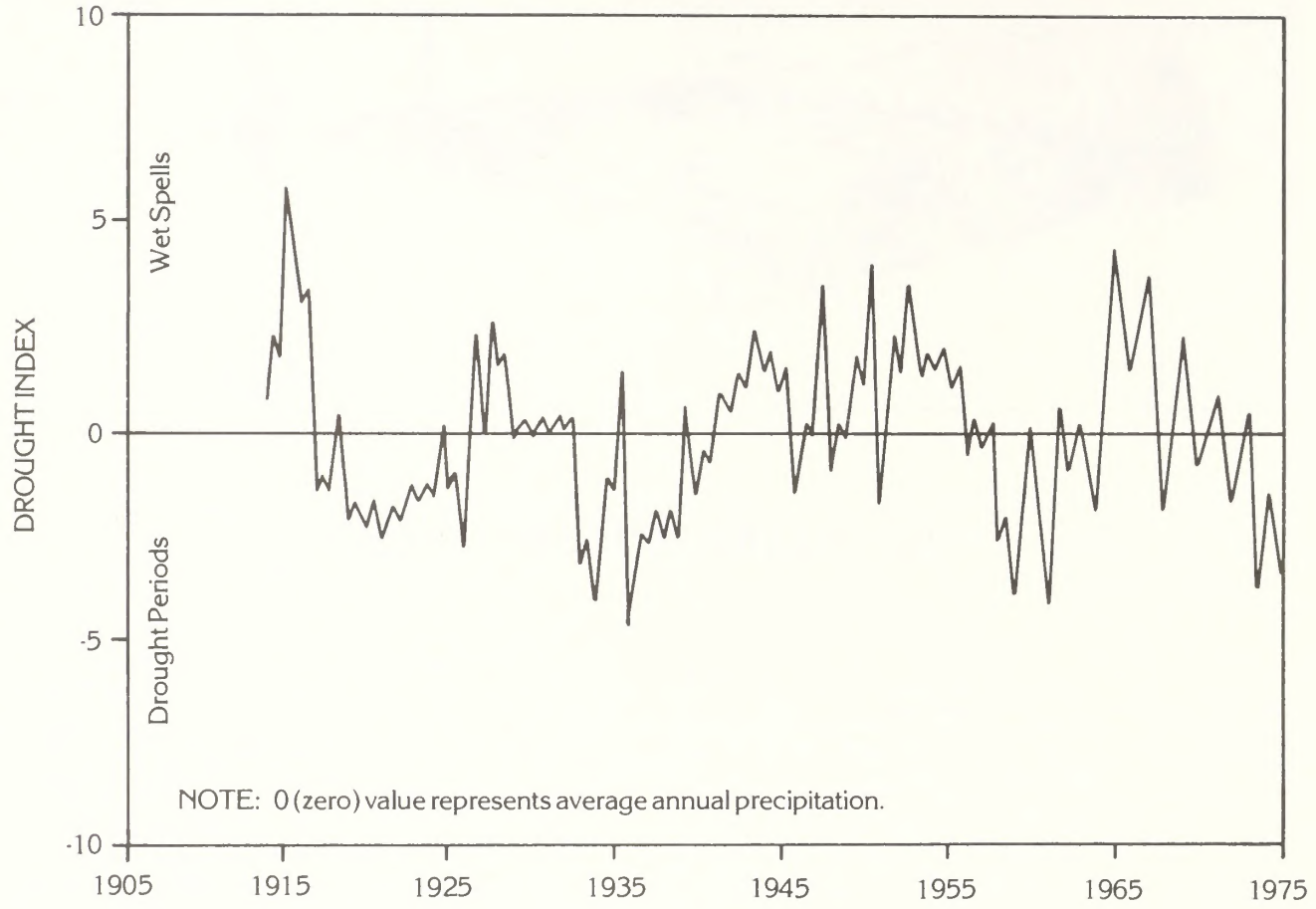
The Fort Union region receives, on the average, about 15 inches of precipitation per year, and most of this occurs in late spring or early summer (May-July) (see Figure 2-1). Snowfall averages about 33 inches per year. Annual averages can sometimes be misleading, however, and it is important to note that precipitation in the Fort Union region often fluctuates greatly from the annual mean (see Figure 2-2).

FIGURE 2-1 MONTHLY DISTRIBUTION OF PRECIPITATION, BISMARCK, N.D.



Source: Trewartha 1961.

FIGURE 2-2 RELATIVE OCCURRENCE OF DROUGHT AND WET SPELL PERIODS IN MANDAN FROM 1905 THROUGH 1975



Source: Ramirez et al., 1976

Prevailing winds in the Fort Union region are from the west-northwest, and average about 12 miles per hour throughout the region (see Figure 2-3). High gusting wind speeds are not uncommon in the region, particularly during the winter months.

Pollutant dispersion is also affected by atmospheric stability, a function of upper air temperatures and winds. The Fort Union region generally experiences frequent temperature inversions, which reduce mixing heights and tend to concentrate pollutants (see Table 2-1).

Pollution

The pollutants which are of importance in the Fort Union region are total suspended particulates (TSP), sulfur dioxide (SO_2), ozone (O_3), nitrogen dioxide (NO_2), hydrocarbons (HC), carbon monoxide (CO), hydrogen sulfide (H_2S), lead (Pb), and various trace elements. Appendix C further identifies these important pollutants.

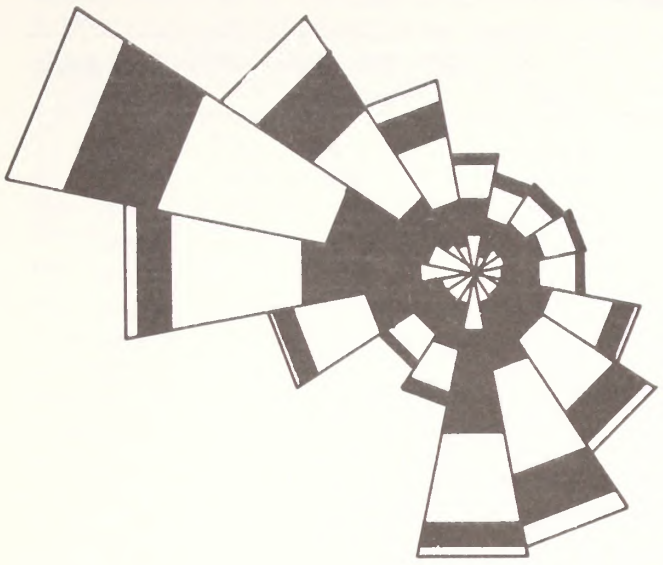
TABLE 2-1

Representative Inversion Frequency and Mixing Height Data*

	Regional Values
Inversion Frequency (base 1500 ft.), %	
Annual	35
Seasonal Range	30-50
Mixing Height, ft.	
Mean Annual Morning	984-1312
Mean Annual Afternoon	4921-5249
Mean Annual Afternoon Range	1968-7874

*Recorded at Bismarck, North Dakota

FIGURE 2-3 WIND ROSE FOR DICKINSON, N.D.



KEY

24.2 +
18.4 to 24.2 mph
11.5 to 18.4 mph
6.9 to 11.5 mph
3.5 to 6.9 mph
0 to 3.5 mph

Wind Direction	%
N	3.6
NNW	5.9
NW	9.3
WNW	14.4
W	10.7
WSW	6.3
SW	3.5
SSW	4.2
S	8.8
SSE	8.6
SE	6.5
ESE	5.1
E	3.3
ENE	3.4
NE	3.2
NNE	3

Source: West-Central Regional EIS, 1978

The estimated quantities of emissions of the above pollutants, in terms of hourly emission rates corresponding to each of the project alternatives, are shown in Table 2-2.

An examination of the TSP data for 1979 and 1980 shows that, in rural areas of eastern Montana, the annual geometric mean concentrations range from 13 to 21 micrograms per cubic meter (ug/m^3) at Scobey, and 20 to 27 ug/m^3 at Fort Peck and Lindsay. The figures represent up to 28% of the Primary National Ambient Air Quality Standard (NAAQS) at Scobey (Appendix E) and 35% of the Primary NAAQS and 45% of the Secondary NAAQS at Fort Peck and Lindsay. The highest 24-hour concentrations observed were 116 ug/m^3 at Scobey, 153 ug/m^3 at Fort Peck, and 208 ug/m^3 at Lindsay, and these represent up to 45%, 59%, and 72% respectively of the Secondary NAAQS. At the urban sites in Glendive and Miles City, Montana, the annual geometric means in 1980 were 18 ug/m^3 (24% of Primary and 30% of Secondary NAAQS) and 55 ug/m^3 (73% of Primary and 92% of Secondary NAAQS), respectively. The highest 24-hour concentrations observed at these sites were 68 ug/m^3 (26% of Primary and 45% of Secondary NAAQS) and 158 ug/m^3 (61% of Primary and 105% of Secondary NAAQS).

High volume sampler filters from Scobey were analyzed for sulfates (SO_4) and nitrates (NO_3) in 1979 and 1980. These analyses indicated mean annual concentrations of SO_4 from 2.6 to 5.9 ug/m^3 and mean annual NO_3 concentrations of 0.7 to 1.1 ug/m^3. These values are consistent with what would be expected for background levels.

Rural sites in western North Dakota showed annual geometric means of 11 to 28 ug/m^3 TSP, and peak 24-hour TSP concentrations generally in the range of 90 ug/m^3 to 290 ug/m^3. In urban areas in North Dakota, annual geometric means were generally from 18 to 29 ug/m^3 TSP. The rural sites reach as high as 47% of the more stringent Secondary NAAQS for the annual geometric mean and as high as 193% of the 24-hour Secondary NAAQS. On the other hand, the urban areas are as high as 48% of the Secondary NAAQS.

In addition to the above major pollutants, trace elements such as those found in lignite coal (Table 2-3) are also expected to be emitted into the atmosphere.

Except near sources, sulfur dioxide concentrations in the region are very near zero. The SO_2 monitoring conducted near Scobey, Montana, for example, indicates an annual average of 3 ug/m^3 (4% of the Primary NAAQS) with an hourly maximum concentration of 43 ug/m^3 (3% of the Montana Ambient Air Quality Standard). Near sources SO_2 concentrations are higher and may on occasion approach PSD allowable increments. The SO_2 baseline date for Montana was established as of August 7, 1977, by the State Air Quality Bureau, and on March 3, 1979, by the U.S. Environmental Protection Agency.

TABLE 2-2
Project Source Emissions Estimates
(Pounds per hour)

	Mine Facilities	TSP Conversion Facilities	Total	SO_2 Conversion Facilities	NO_2 Conversion Facilities
Alternative 1	3,455	0	3,455	0	0
Alternative 2	7,812	1,222	9,034	11,783	10,576
Alternative 3	10,954	1,996	12,950	32,373	33,536
Alternative 4	12,218	2,196	14,414	32,043	29,896
Alternative 5	13,686	3,146	16,832	44,173	38,336
Alternative 6	16,087	4,656	20,743	65,424	54,316
Meridian Exchange	12,039	2,108	14,147	34,973	37,956
Woodson PRLA	11,531	2,371	13,902	39,903	39,176

TABLE 2-3
Trace Elements in Lignite Coal
(Micrograms per gram)

	NDSDH Study (1977)			Older Literature Averages
Element	Min.	Max.	Arithmetic Mean	Expected Average Conc. Range
Arsenic	< 0.54	18.0	2.07	5.0
Beryllium	< 0.10	4.3	0.75	0.1 - 4.0
Cadmium	< 0.10	0.27	0.13	0.10 - 0.53
Chromium	< 0.10	13.0	1.29	4.0
Copper	0.53	7.7	2.88	< 1.0 - 0.53
Fluoride[1]	7.4	25.0	15.53	25.0 - 150.
Lead	< 0.10	0.51	0.26	0.5 - 7.0
Mercury	< 0.02	0.28	[3]	< 0.2
Molybdenum	0.64	6.4	1.63	< 1.0 - 17.0
Nickel	0.12	5.8	0.93	1.3 - 4.0
Selenium	< 0.18	0.58	0.30	0.4 - 8.0
Uranium	< 0.10	1.4	0.47	
Vanadium	< 0.60	19.0	2.69	0.2 - 25.0
Zinc	0.30	37.0	2.56	2.9
Sulfur[2]	0.37%	2.29	0.72%	< 0.7% - 1.5%

[1]As total fluoride.
[2]As total sulfur, % weight
[3]30% of samples less than detectable limit, resulting in arithmetic mean which would fall below 0.02.
[4]Composite from literature search with averages from existing lignite coal data.

Source: North Dakota State Department of Health, 1977.

In North Dakota, SO_2 concentrations recorded by privately owned impact source monitoring sites show annual means to be less than 5 ug/m³ (6% of the Primary NAAQS). Highest 1-hour concentrations ranged from 89 ug/m³ to 394 ug/m³ (12% to 55% of the North Dakota Ambient Air Quality Standards). The 1979 air quality computer modeling estimates by the North Dakota State Department of Health indicated that the allotted 24-hour SO_2 Class I PSD increment for the South Unit and the 3-hour SO_2 increment for the North Unit of the Theodore Roosevelt National Park are nearly or already consumed.

There are a number of existing pollution sources in the Fort Union region, and the major point and area sources in the Montana half of the region include Montana Dakota Utilities (MDU), Shell Oil, Holly Sugar, Perry Petrolane, and Knife River Coal in Richland County, and the Valley County Industrial Park and KENCO in Roosevelt County. These sources emitted an estimated 4566 tons of SO_2 and 671 tons TSP in 1980. Other Montana sources outside the Fort Union region, such as Montana Power Company's coal-fired power plants at Colstrip, also may impact the region's air quality (see Appendix D). The new Canadian power plant across the Montana border at Coronach also may affect the region's air quality.

In the North Dakota portion of the Fort Union region, there also are a number of major emission sources including the MDU Coyote plant, Basin Electric's Antelope Valley Stations I and II, the Warren Petroleum Company Gas Processing Plant, and various existing coal mines (see Appendix D). PSD permits are pending for the AMOCO Production Company, Minnesota Power & Light, Phillips Petroleum, an expansion of the Warren Petroleum facility, Nokota, and Basin Electric's Antelope Valley Station III. Another source proposed for the region includes the Great Plains Gasification plant.

In addition, there are an increasing amount of sour gas emissions associated with oil development in the region which result in SO_2 and H_2S emissions where the gas is flared and used on lease. There are also TSP and other pollutant contributions from traditional area sources such as unpaved roads, agricultural field operations, open burning, construction activities, and vehicle exhaust.

Visibility

Visibility in the Fort Union region is generally quite good, and in eastern Montana visibility ranges from 45 to 70 miles. In fact, visibility greater than 60 miles is common. At the Theodore Roosevelt National Park in western North Dakota, visibility in 1979 ranged from 73 to 96 miles. Significant reductions in the region's visibility are generally weather related (see Appendix E).

Air pollution also may result in significant visibility reductions and the effects of such reductions include not only aesthetic degradation of the environment but also economic burdens on society.

There are two main types of visibility impairment which may be of concern in the Fort Union region, and they are atmospheric discoloration (plume blight) and visual range reduction (general haze).

Plumes from coal-fired power plants or other sources may be discolored due to nitrogen oxide (NO_x) emissions that are converted to nitrogen dioxide (NO_2) in the atmosphere. The NO_2 may give the plume a reddish-brown color. Atmospheric discoloration due to NO_x emissions is greatest during periods of stable conditions with light winds following nighttime transport. However, since a plume tends to remain intact during such conditions, the discoloration would be confined to a small area (streak) in the sky.

Increased general haze, resulting in visibility reduction, is caused primarily by particulate emissions (TSP) and secondary aerosols, such as sulfates resulting from sulfur dioxide (SO_2) emissions. General haze is greatest during light wind, limited mixing, or stagnation conditions after daytime transport. Under these conditions, conversion of gaseous precursor emissions to secondary aerosols is more rapid. Consequently, an individual plume may not be visible at all, but the general haze formed by regional emissions would cause decreased contrast and loss of clarity in the landscape.

Visibility reduction in the atmosphere due to manmade pollution is primarily caused by (1) light scattering by particles and (2) light absorption by particles and gases.

Particles suspended in the air reduce visibility, or visual range, by scattering and absorbing light coming from both an object and its background, thereby reducing the contrast between them. Moreover, suspended particles scatter light into the line of sight, illuminating the air between, to further degrade the contrast between an object and its background. Light scattering by particles is the most important cause of visual reduction, and particulates with diameters from 0.1 to 1.0 microns (um) are the most effective per unit mass in scattering light. Light absorption by particles also is significant when finely divided carbon particles (soot) are present.

Light absorption by gases also may be important to visibility in the Fort Union region because nitrogen dioxide (NO_2), resulting from NO_x emitted by power plants and other sources, absorbs light. The NO_2 absorbs light strongly at the blue end of the visible spectrum, while allowing light at the red end to pass through. In the atmosphere it reduces the brightness and contrast of distant objects, and causes the horizon, sky, and white objects to appear pale yellow to reddish-brown.

Congress has recognized the problem of visibility degradation and addressed it for mandatory Class I areas, or various national parks and other such federal lands, in the Clean Air Act of 1977. In Section 169A (a) (1) of the Act, Congress declared "as a national goal the prevention of any future, and the remedying of any existing, impairment of visibility in mandatory Class I Federal areas, which impairment results from man-made air pollution."

The Environmental Protection Agency subsequently has issued visibility regulations implementing the statute, which provide protection of visibility within Class I areas and also with respect to "integral vistas" associated with Class I areas (40 CFR 51.300 et. seq.). An "integral vista" is a view from within a Class I area, which is important to the visitor's visual experience of the Class I area itself. The National Park Service, Federal Land Manager for the Theodore Roosevelt National Park, has identified a number of integral vistas associated with that Class I area (Table 2-4). No integral vistas, however, have been listed by the Fish and Wildlife Service, Federal Land Manager for the other Class I areas in or near the Fort Union region.

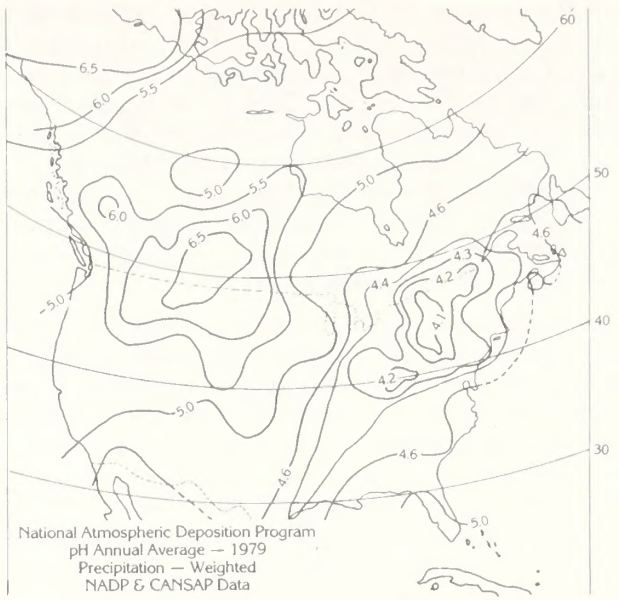
Class I visibility is protected under EPA regulations by requiring each affected state to develop a program to assure reasonable progress toward meeting the national goal of remedying existing and preventing future visibility impairment by manmade air pollution. Among other things, the visibility program must include requirements that certain existing major stationary sources of pollution affecting Class I visibility be retro-fitted with the best available technology to reduce such impacts, and that Class I visibility impacts of new major stationary sources or major modifications be reviewed as part of the PSD permit review process to ensure their emissions will be consistent with making reasonable progress toward the national visibility goal.

At the present time, neither Montana nor North Dakota has amended its state implementation plan to meet the federal Class I visibility requirements. Both states, however, have adopted an ambient air quality standard governing visibility in general (Appendix E).

Acid Precipitation

Precipitation is naturally somewhat acidic (with a pH of about 5.6) because of the dissolution of atmospheric carbon dioxide to form carbonic acid. The term "acid precipitation" is generally applied to precipitation with a pH lower than 5.6, indicating that sources other than carbon dioxide cause the acidity. A whole number change in the pH value indicates a tenfold change in acidity. In the Fort Union region, the annual precipitation pH average currently is 6.0-6.5, or less acidic than might be expected (National Atmospheric Deposition Program (NADO) 1970; North Dakota State Department of Health 1977) (see Figure 2-4).

FIGURE 2-4 NATIONAL ATMOSPHERIC DEPOSITION PROGRAM



Although pH is an indication of acidity, the chemical composition of precipitation must be known to characterize the source of the acidity. Analyses of the chemical composition of acid precipitation over the eastern United States indicate the dominance of ions found in sulfuric acid and nitric acid; preliminary analyses of acid precipitation in the western United States suggest the dominance of ions found in nitric acid. Preliminary results from one investigation in Colorado suggest that precipitation with a pH of 4.6 may be infrequent and may be caused largely by the presence of nitric acid.

The precursors to the formation of sulfuric acid and nitric acid in the atmosphere are sulfur oxides and nitrogen oxides. Some of these undoubtedly come from fossil fuel combustion emissions, although quantitative relationships are still obscure. Some effects of the acidity are well recognized, but in this respect too, the relationships are obscure and controversial. Chemical transformations of gaseous sulfur dioxide to sulfuric acid and of gaseous nitrogren oxides to nitric acid are influenced by atmospheric conditions and may be enhanced by certain catalysts (e.g., vanadium, iron, manganese) and the presence of other pollutants such as ozone and reactive hydrocarbons.

The amount of acid deposited from the atmosphere has been of particular concern since the early 1950's when scientists determined that acid deposition was related to chemical and ecological changes in rivers and lakes in Scandinavia. Acidity and toxic substances (e.g., heavy metals) also have been observed to increase in many North American lakes and rivers,

TABLE 2-4
Integral Vistas Associated with the Theodore Roosevelt National Park

Observation Point	View Angle	Key Feature	Also Viewed From
Badlands Overlook	353°-7°	Badland terrain	Johnson's Plateau, Painted Canyon, Ridgeline Nature Trail, Buck Hill
Bentonitic Clay	64°-94‡	Killdeer Mountains, Long X Divide	Shelter Overlook
Boicourt-South	185°-248°	Bullion Butte, Square Butte	Buck Hill, Ridgeline Nature Trail, Johnson's Plateau
Boicourt-West	267°-298°	Camel's Hump, Twin Buttes	Ridgeline Nature Trail, Buck Hill
Buck Hill	0°-360°	Sentinel Butte, Square Butte, Camel Hump, Twin Buttes	Painted Canyon, Ridgeline Nature Trail, Johnson's Plateau, Badlands Overlook, Boicourt Ridge
Elkhorn Ranch Site	—	View of surrounding bluffs	
Johnson's Plateau-North	358°-54°	North Dakota Badlands	Badlands Overlook, Ridgeline Nature Trail, Buck Hill, Painted Canyon
Johnson's Plateau-South	117°-261°	DeMores Chateau, Bullion Butte, Square Butte, Sentinel Butte	Buck Hill, Ridgeline Nature Trail, Boicourt Ridge
Little Missouri	78°-110°	Custer National Grassland Plateau	Shelter Overlook
Man and Grass	226°-14°	Stock Butte, Little Missouri Grassland	
Medora Overlook	149°-250°	Theodore Roosevelt's Maltese Cross Cabin, DeMores Chateau, Little Missouri Town Site	
Oxbow	65°-224°	Killdeer Mountains, Achenbach Hills, Sperati Point	
Painted Canyon	303°-0°	Buck Hill, Little Missouri National Grassland	Ridgeline Nature Trail, Boicourt Ridge, Badlands
Ridgeline Nature Trail	0°-360°	Bullion Butte, Square Butte, Sentinel Butte, Camel's Hump, Twin Buttes	Johnson's Plateau, Buck Hill, Painted Canyon Overlook, Boicourt Ridge

Source: National Park Service, 43 Federal Register 3656 (January 15, 1981)

particularly in New England and southeastern Canada, over the past several decades. This increased acidity apparently has resulted in more than 100 fishless lakes in the Adirondack area of New York, more than 140 fishless lakes in the Canadian province of Ontario, and more than 15,000 fishless lakes in Sweden. Several thousand lakes in Minnesota and Wisconsin and 48,000 lakes in the province of Ontario are considered susceptible to increased acid levels.

Aquatic ecosystems are vulnerable to the effects of acid deposition in a number of ways. Increased river and lake acidity affects the hatching of fish eggs and the ability of young fish to survive, and the sudden injections of acid during the spring thaw from accumulations in winter snows can kill even mature fish. Acidification also may adversely affect amphibians and other components of the aquatic ecosystem such as aquatic plants and micro-organisms. Apart from the direct effects of increased acidity in the aquatic habitat, materials leached from surrounding soils by acidic solutions may be biological toxicants.

The effects of acid deposition on terrestrial ecosystems are not as certain or as easily quantifiable as the impacts on aquatic ecosystems because of the great number of species of plants and animals, the long time-frames of change in many ecosystems, and the complex inter-relationships among and between organisms and their environment. Some studies based on laboratory exposure to simulated acid precipitation have indicated that its effects on vegetation may include the leaching of important elements and compounds from the plant, increased vulnerability to plant pathogens, and higher susceptibility to drought.

Environmental sensitivity or tolerance to acid deposition varies from area to area. The sensitivity of lakes and rivers to acid deposition varies, depending on the buffering capacity (degree of alkalinity) of the surrounding soils. Vegetation in areas with acid-sensitive soils is considered particularly vulnerable. Soils in the Fort Union region, however, tend to be alkaline.

In addition to potential ecological harm, acid deposition has been linked by some studies to damage of building materials, painted surfaces, and statues. In the Fort Union region, the only recorded corrosive atmosphere problems occurred during the 1960's in the oil and sour gas production areas of the northwestern corner of North Dakota. Farm machinery and metal farm buildings were apparently damaged by sulfurous gases in combination with water vapor. These problems occurred prior to an air pollution control law in North Dakota, and industry voluntarily corrected them.

With respect to the potential impact of acid precipitation on human health, it is generally believed that there is little cause for concern over direct health effects from acid deposition since the pH of acidic precipitation is generally well within the range normally tolerated by the skin and gastrointestinal tract. Some attention has been focused, however, on indirect health effects. There are two such effects often discussed, both involving the metals which can be dissolved and carried by water of greater than usual acidity. These are contamination of edible fish with mercury, and contamination of drinking water by heavy metals such as lead leached either from watersheds or from water storage and distribution systems. At the present time, the evidence to substantitate these concerns apparently is inconclusive.

It is important to note that considerable controversy surrounds the causes and effects of acid precipitation. A recent report by the General Accounting Office has attempted to clarify the actual areas of agreement and disagreement between the parties to the acid precipitation debate and to summarize the current state of scientific understanding of the issues (GAO, *The Debate Over Acid Precipitation,* EMD-81-131, September 11, 1981). Among the issues of particular interest for the Fort Union region are: (1) the relative contributions of natural and manmade pollution to acid precipitation; (2) the extent to which local versus distant sources are responsible for acid precipitation; and (3) the impacts of acid precipitation on the terrestrial ecosystem, including crops.

As previously noted, preliminary analyses of acid precipitation in the western U.S. indicate a higher level of nitric acid than sulfuric acid. Nitric acid may result from either natural or manmade sources. Lightning can form nitrogen oxides from the nitrogen and oxygen in the air, and other natural sources, such as wildfire, decomposing organic matter, and plant life release significant amounts of nitrogen compounds which can be converted to oxides in the atmosphere. Manmade sources include stationary sources such as fossil-fueled electric utilities and industrial plants, mobile sources using gasoline and other fossil fuels, and commercial and residential heating. Manmade non-energy sources also contribute nitrogen compounds from wind-blown agricultural fertilizers. The manmade NO_x emissions in the U.S. are quite substantial—almost as large as SO_2 emissions. However, good estimates of NO_x emissions by natural sources are not available, so the relative shares of natural and manmade NO_x are not clear.

With respect to manmade pollutants contributing to acid precipitation, widespread disagreement also exists over the extent to which local versus distant sources are responsible for acid precipitation. Complex events in the atmosphere, both physico-chemical and meteorological, determine whether, where, and how much deposition occurs. At present, the relative rates and timing of transport, transformation, and deposition are not fully understood. Most research to date has focused on long-range transport of sulfur compounds from coal-fired power plants. Some recent reports, however,

argue that local combustion, particularly of residual home heating oil and fuel for motor vehicle sources, could be major contributors. Scientific work suggests that both contribute but has not firmly established the shares from each.

Finally, there is no clear consensus as to the potential impact of acid precipitation on crops. Most scientists say that more research is needed before we have an adequate understanding of the effects of acid deposition on terrestrial ecosystems. This contrasts with the general agreement among scientists that oxides of sulfur and nitrogen, ozone, and certain other gases can cause damage to vegetation, including economic damage to crops, when present in sufficient concentrations.

It is evident that the phenomenon of acid precipitation is extremely complex, and that it is a serious current problem in some parts of the world. Presently,there is no significant evidence of acid precipitation in the Fort Union coal region, however, no specific research has been completed for the Ft. Union area. The data that supports the no significant evidence conclusion was interpolated data from NADP sites outside the Ft. Union area. Currently, the North Dakota State Department of Health is conducting research on acid precipitation in North Dakota and preliminary results may show different evidence concerning the Ft. Union area than previously presented. These results should be available for presentation in a special Air Quality impact analysis report which will be issued in late August 1982 for public review and comment.

Federal law for the control of air pollution has been evolving for over a decade. Congress passed the Air Quality Act, the first clean air legislation, in 1967. This was followed by the Clean Air Acts of 1970 and 1977 in which Congress reaffirmed its determination to cope with the growing national problem of air pollution. In 1982, Congress again is considering further amendments to its air quality legislation.

The Environmental Protection Agency (EPA) has the major federal role in ensuring compliance with the requirements of the Act. EPA issues national air quality regulations, approves and oversees state implementation plans, and conducts major enforcement actions.

State air pollution control agencies have the primary responsibility for carrying out the Act on non-Indian lands through the development and execution of an acceptable State Implementation Plan (SIP), which must provide for the attainment and maintenance of air quality standards within the state. The states of North Dakota and Montana both have EPA-approved State Implementation Plans.

With respect to Indian lands, EPA currently has air quality jurisdiction since it has not been given authority to delegate that responsibility to the states or to the Tribes themselves. EPA, however, is assisting tribes within the Fort Union region, including the Fort Peck Reservation in eastern Montana and the Fort Berthold Reservation in western North Dakota, in the establishment of tribally operated air quality programs with ambient monitoring capabilities.

The basic regulatory framework of the present Clean Air Act involves National Ambient Air Quality Standards (NAAQS) and allowable increments for the Prevention of Significant Deterioration (PSD) of air quality.

National Ambient Air Quality Standards

NAAQS are absolute, nationwide limits on the amount of certain pollutants which may be present in the air. No part of the country may exceed these minimum levels. The federal government has set primary standards to protect public health and secondary standards to protect the general public welfare. The states of North Dakota and Montana have set their own ambient standards for the same pollutants, which are at least as stringent as the federal standards (Appendix E).

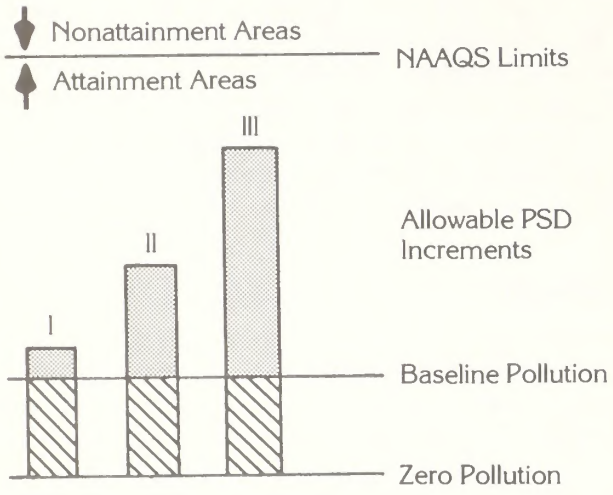
To enforce the NAAQS requirements, all parts of the country have been classified as (1) an "attainment" area where air quality levels are better than the NAAQS limits, (2) a "nonattainment" area where pollution levels in the air exceed the NAAQS limits, or (3) an "unclassifiable" area where there is insufficient data to classify them. Nonattainment areas, typically urban, are subject to regulatory requirements designed to bring area pollution levels down to the NAAQS ceiling. No part of the Fort Union region is classified "nonattainment" for any pollutant. Attainment and unclassifiable areas, or all of the Fort Union region, are subject to PSD requirements.

Prevention of Significant Deterioration

The PSD program is designed to protect the air quality from significant deterioration in areas already meeting the NAAQS. In other words, they allow a specific increase or "increment" in pollution, over and above the existing air quality "baseline" pollution levels, in cleaner areas. In no event, however, may pollution increases exceed the NAAQS (Figure 2-5).

The size of the increment allowable under the PSD program depends on the area's designation as a Class I, II, or III area, with Class I areas allowed the smallest pollution increment and Class III the largest (Table 2-5). In the 1977 Act, Congress designated certain national parks and other such areas as Class I areas. All other areas were designated Class II. Congress, however, provided a procedure for state and tribal governments to redesignate areas under their jurisdiction as Class I or III.

FIGURE 2-5 INTERACTION OF NAAQS AND PSD STANDARDS



Source: GeoResearch, Inc. 1981.

TABLE 2-5
Federal and State PSD Increments (ug/m³)

Deterioration Increments for Area Designations	Federal and Montana	North Dakota
Particulates		
Class I		
annual geometric mean	5	5
24-hour maximum	10	10
Class II		
annual geometric mean	19	10
24-hour maximum	37	30
Class III		
annual geometric mean	37	37
24-hour maximum	75	75
Sulfur Dioxide		
Class I		
annual arithmetic mean	2	2
24-hour maximum	5	5
3-hour maximum	25	25
Class II		
annual arithmetic mean	20	15
24-hour maximum	91	91
3-hour maximum	512	512
Class III		
annual arithmetic mean	40	40
24-hour maximum	182	182
3-hour maximum	700	700

Sources: Title 40 CFR, Part 51; Administrative Rules of Montana, 16-8-904, 1979; Chapter 33-15-15 NDAC.

North Dakota's PSD increments are somewhat more stringent than the federal standards with respect to Class II areas. Montana's PSD increments are identical to the federal standards. Montana's PSD program has not been approved yet by EPA, however, Montana presently is in the process of amending its program to secure such approval. The applicable PSD increments for the two states are set forth in Table 2-5.

PSD requirements are enforced by a complex pre-construction permit system for major new stationary pollution sources and for major modifications to existing sources. The PSD permit process involves the study of existing air quality, requirements for the use of best available pollution control technology, and various impact studies to ensure that PSD standards (established thus far only for particulate matter and sulfur dioxide) will not be exceeded by allowing the pollution source to operate in the area.

If the PSD source is to be located near a Class I area, it may not exceed the PSD standards nor have any adverse impact on the air quality-related values (including visibility) of the Class I area. Visibility, as previously noted, is protected both within the Class I area itself and also with respect to "integral vistas" extending outside the Class I boundary.

If a proposed PSD source cannot satisfy the maximum allowable deterioration increments for a mandatory Class I area, they may have an opportunity to seek a waiver or a variance. Under Federal and North Dakota law, three possible variance routes are open to such a source, involving the Federal Land Manager of the Class I area, the Governor of the State, and possibly the President of the United States (Section 165 (d)(2)(C) and (D) of the Clean Air Act; North Dakota State Department of Health, Air Pollution Control Regulations 1978). The state of Montana regulations presently do not afford variances from Class I PSD requirements; however, Montana's Air Quality Bureau has proposed regulations which would provide them. Montana does have variance procedures involving the Governor under the Federal Clean Air Act as mentioned above.

If a new emission source is not sufficiently "major" to require a PSD permit, it nonetheless must obtain a permit or otherwise comply with other applicable air quality standards.

Fort Union Air Classification Areas

All of the Fort Union region currently is designated Class II, with the exception of Congressionally mandated Class I areas including: Theodore Roosevelt National Park in McKenzie and Billings counties in southwestern North Dakota; Lostwood National Wilderness Area in Burke County, North Dakota; and Medicine Lake Wilderness Area in Sheridan County, the northeasternmost part of Montana. Two other federal

Class I areas which are just outside the Fort Union region are the Northern Cheyenne Indian Reservation and the UL Bend Wilderness Area. The UL Bend Wilderness Area is located near the confluence of the Missouri and Mussellshell Rivers in Phillips County, Montana, and the Northern Cheyenne Indian Reservation is located in Big Horn and Rosebud Counties, Montana. In addition, the Fort Peck Indian Reservation in Daniels, Valley, Roosevelt, and Sheridan counties of northeastern Montana, has notified the Bureau of Land Management that redesignation of reservation air quality to Class I status is under active consideration.

Due to the small amount of incremental pollution allowed under Class I standards, the greatest air quality regulatory constraint on new development in the Fort Union region most likely will be regulatory compliance within these PSD Class I areas.

According to computer dispersion modeling analyses conducted by the State of North Dakota, the PSD SO_2 24-hour increment for the South Unit of the Theodore Roosevelt National Park already has been consumed or nearly consumed, and the 3-hour SO_2 increment has been largely consumed for the North Unit by previously permitted PSD sources. This represents a potential constraint on the siting of new facilities emitting SO_2 in western North Dakota. Further complicating the PSD regulatory picture at Theodore Roosevelt National Park is the new visibility protection provided for a number of integral vistas extending outside the park's boundaries (see Table 2-4).

WATER

Hydrology

Surface runoff from the coal areas generally drains through intermittent streams into local perennial streams and on into the Yellowstone and Missouri rivers. Most of the surface water within the Fort Union region occurs in the mainstem Yellowstone and Missouri rivers and the Missouri's reservoir system and originates in the high country to the south and west. The quality of this water is a sodium calcium sulfate bicarbonate type with total dissolved solids (TDS) concentrations ranging from 300 to 700 mg/l. The local perennial streams usually have peak flows during the spring snowmelt and have somewhat poorer quality water. These waters are sodium sulfate bicarbonate types with a TDS concentration ranging from 700 to 2500 mg/l (see Tables 2-6 and 2-7). The local ephemeral and intermittent streams that occur within the coal tracts may have their peak flow either as a result of snowmelt or a summer thunderstorm, and the annual runoff to these streams is between one-half and one inch. The quality of the smaller streams is similar to that of the local perennial streams.

Groundwater is distributed much more evenly over the region, however, it is not available in as much quantity as surface water. There are generally four hydrogeologic aquifer zones above the Pierre shale that will yield fresh water to wells (see Figure 2-6). The Fort Union and the alluvium and till aquifers occur within the near surface mineable zone. The geology of the Fort Union formation is silt and clay interbedded with layers of sandstone and lignite, and these sandstones and lignites are the water yielding units. Water movement through this system is extremely slow and yields are usually around ten gallons per minute, and these conditions exist in all of the tracts. In most of the tracts the mineable coal bed is below the water table. The water in this system has TDS concentrations in the range of 1000 to 3000 mg/l. The alluvium and till aquifers are unconsolidated and will yield water at a rate of up to 500 gallons per minute or more. These aquifers occur along the perennial stream channels, buried preglacial channels, or buried glacial meltwater channels. Only about half of the tracts have these channel deposits within their boundaries, and they usually lie around the edges of the mineable lignite. Where they do occur within the interior of a tract, the mineable lignite has usually been eroded away by the channel.

Water Use

Surface water is used for livestock, irrigation, municipal, and industrial water supplies. Within the potential lease tracts are numerous small livestock watering reservoirs. The Redwater River in the Redwater I and II tracts and Spring Creek in the Dunn Center tract are water sources for irrigation land. The Heart River is impounded to form Lake Patterson a few miles downstream from the Zenith tract, and this reservoir is the primary municipal supply for the city of Dickinson and also stores water for irrigators down-stream. All three of these streams have good potential for being designated as alluvial valley floors as defined in the 1977 Surface Mining Control and Reclamation Act.

Groundwater is used for domestic, livestock, municipal, and some irrigation water supplies. The farms and ranches within the tract areas rely on groundwater for all of their domestic needs and most of their stockwatering needs. Most of these wells are finished in the shallow lignite and sandstone beds, and in many of the tracts undeveloped springs provide a year round source of stockwater. Most of the small towns in the region rely on groundwater for their municipal supply systems, and the towns near the tracts generally use the Fox Hills-Hell Creek aquifer (see Figure 2-6). The city of Beach, North Dakota, has a few shallower wells that are used to supplement water supplies during the summer lawn sprinkling season.

TABLE 2-6

Discharge and Water Quality Summaries for the Heart River, Spring Creek and Redwater River

Heart River at South Heart, North Dakota
October 77—September 81

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept	Oct.	Nov.	Dec.
Mean Disch ft³/sec*	.65	.93	183	87	18	8	2	3.1	3.2	7.5	.82	.75
Mean Total Dissolved Solids mg/l**	2655	2448	1145	1123	1898	2135	1905	1281	1266	1202	1855	2558
Mean Suspended Sediment mg/l	152	131	122	153	80	113	136	99	453	118	68	172
Mean Sulfates mg/l	1080	1050	510	550	923	1040	845	567	595	473	825	1058
Mean pH	8.0	8.0	7.9	8.1	8.3	8.4	8.4	8.6	8.4	8.3	8.5	8.0
Mean Temp. °C	0.1	0.3	0.8	3.3	9.8	20.5	20.5	18.0	16.7	7.3	2.6	1.0
Mean % Sodium	83	84	72	72	73	74	81	80	80	84	84	84

Spring Creek at Halliday, North Dakota
October 77—September 81

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept	Oct.	Nov.	Dec.
Mean Disch ft³/sec	3.4	7.1	56.3	84.5	15.9	11.4	6.8	3.5	3.6	4.5	4.0	4.1
Mean Total Dissolved Solids mg/l	1465	1104	608	856	1142	1187	1293	1303	1373	1403	1431	1427
Mean Suspended Sediment mg/l	81	45	307	76	48	80	63	59	31	73	41	48
Mean Sulfates mg/l	655	495	254	373	533	555	610	615	640	583	653	705
Mean pH	7.8	7.6	7.7	7.9	8.4	8.2	8.4	8.5	8.4	8.4	8.3	7.8
Mean Temp. °C	0.1	0.3	2.8	6.3	13.7	19.2	22.5	23.5	14.7	8.5	1.8	0.0
Mean % Sodium	55	53	55	59	55	57	64	61	60	58	53	60

Redwater River at Vida, Montana
October 75—September 81

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept	Oct.	Nov.	Dec.
Mean Disch ft³/sec	2.5	34.8	146	198	39.3	58.3	67.5	15.4	7.6	5.7	5.9	4.2
Mean Total Dissolved Solids mg/l	2946	1871	1220	1895	2368	2214	2604	1983	2325	2027	2238	2788
Mean Suspended Sediment mg/l	65	56	266	202	126	375	114	126	60	63	55	65
Mean Sulfates mg/l	1500	938	623	987	1267	1258	1153	1224	1230	1038	1133	1400
Mean pH	8.0	8.0	8.3	8.5	8.6	8.7	8.7	8.6	8.8	8.6	8.5	8.2
Mean Temp. °C	0.2	0.3	2.7	11.0	15.3	21.4	24.8	23.4	15.4	7.2	2.2	0.2
Mean % Sodium	72	69	62	66	71	71	71	70	75	73	72	74

*Cubic feet per second

**Milligrams per liter

TABLE 2-7

Measured and Standard Values of Water Quality Parameters in the Heart River, Spring Creek and Redwater River

Water Quality Parameters	Measured[4]						Standards[3]	
	Heart River Value[1]		Spring Creek Value[1]		Redwater River Value[1]			
	No.	Range	No.	Range	No.	Range	Heart River and Spring Creek	Redwater River
Total Dissolved Solids		(2)		(2)		(2)	—	—
Suspended Sediment		(2)		(2)		(2)	No Increase	No Increase
Sulfates (Dissolved)		(2)		(2)		(2)	450 mg/l	—
sodium		(2)		(2)		(2)	60%	—
pH		(2)		(2)		(2)	7.0-8.5	6.5-9.0 change < 0.5 otherwise no change
Temperature		(2)		(2)		(2)	85°F or 5°F above background	85°F or 3°F above background
Arsenic (Total)	8	2-14	7	1-3	15	0-35	50	50
Barium (Dissolved)	11	0-300	12	0-200	0		1000	1000
Cadmium (Total)	5	0-3	5	0-1	12	0-5	10	10
Chromium (Total)	8	0-10	8	0-20	10	0-40	50	50
Cyanides (Total)	0		0		0		5	5
Iron (Dissolved)	42	10-565	41	10-220	69	10-320	—	300
Lead (Dissolved)	7	0-10	6	0-4	13	0-29	50	50
Molybdenum (Total)	7	0-8	6	0-5	7	1-6	—	—
Selenium (Total)	8	0-1	7	0	15	0-8	100	10
Vanadium (Dissolved)	10	0-32	10	0-6	6	0-12	—	—
Zinc (Total)	8	10-30	7	10-60	13	0-130	1000	5000

[1]Reported values are in micrograms per liter unless otherwise indicated.

[2]These parameters are reported in Table 2-6.

[3]Water Quality Standards or guidelines for maximum limits (unless otherwise indicated) adopted by the states reported in micrograms per liter unless otherwise indicated.

[4]Source is USGS data.

AGRICULTURE

Soils and Reclamation Potential

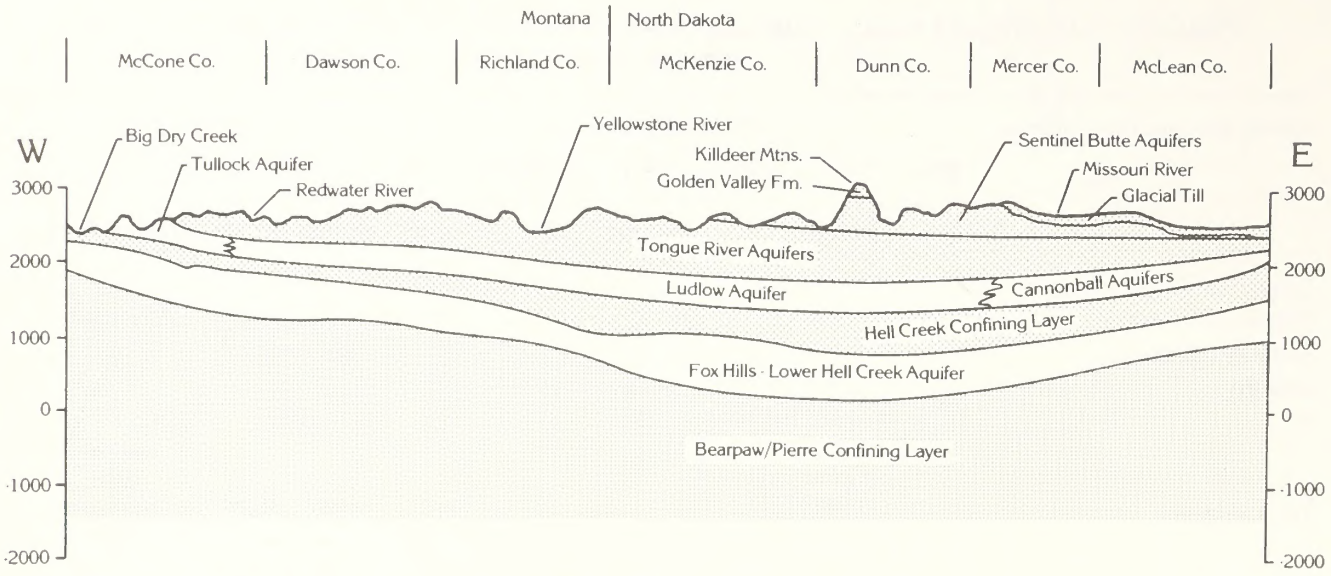
Soils within the Montana tracts are formed in weakly consolidated sandstone, alluvium and glacial till. The soils occur along steep, dissected, sedimentary plains and nearly level to rolling high terraces on uplands. Profile development and depths vary due to climate, parent material, and geomorphic stability.

Soils within the North Dakota tracts are somewhat more varied. Soils derived from glacial till are common with some wind blown material over the till. Other soils are primarily derived from shale, siltstone, and sandstone parent materials either in place or reworked by wind and water. Due to parent material and climate, the North Dakota soils tend to moderately-deep and deep profiles, somewhat deeper on the average than those formed under lesser moisture regimes in Montana.

Wind erosion hazards overall are related primarily to wind exposure and soil textures, varying from low to high as soil texture occurrence changes from loamy to sandy.

Water erosion potentials also are related to soil texture and most importantly to topographic variations in slope. As sandy loam soils increase in slope to ten percent grades, water erosion hazards become high. Channeled alluvial soils also exhibit water erosion hazards.

FIGURE 2-6 GENERAL HYDROGEOLOGIC SECTION OF FORT UNION REGION



Source: Stoner and Lewis, USGS, Misc. Investigations Series Map I-1236, 1980 and Bluemle, NDGS, Geologic Highway Map of North Dakota, 1977.

Among Montana tract acreages where erosion potential is higher due to sedimentary parent materials and more arid climatic conditions, lands with high wind erosion potential compose 36 percent of the total tract acreage. High water erosion hazard constitutes 32 percent, based on the Soil Conservation Service (SCS) Order II survey and soils technical guides.

Suitable plant growth material within each series surveyed by the SCS at the Order II level has been categorized into Good, Fair, Poor, and Unsuitable classes according to guidelines developed by BLM and adapted from criteria developed by the Office of Surface Mining (OSM) and by Wm. Schafer, Reclamation Research Unit, Montana State University.

Soils with poor reclamation potential among the Montana tracts range from 17 percent of tract acreage in the Bloomfield tract to a high of 62 percent for the Burns Creek tract acreage.

In North Dakota the two Wibaux-Beach tracts average 6 percent poor reclamation potential soils, while Zenith has a high of 44 percent of tract acreage rated as poor. The remaining tracts range from a low of one percent poor soils in the Underwood and Sakakawea tracts to a high of 14 percent poor reclamation potential in the Dunn Center tract.

Currently, 8202 acres have been disturbed by mining activities adjacent to the seven maintenance tracts under consideration for additional coal leasing in Alternative 1. The future environment without the proposed coal leasing scenarios includes the disturbance in soils and agricultural production associated with these existing mines. Of the seven tracts analyzed in Alternative 1, those private and state surface lands already under lease, along with any additional acreage which would be leased as development proceeds, also would be subject to disturbance. Of the seven tract areas, only those acres over federal coal actually would be dependent upon the leasing decision of the Secretary of the Interior.

Soil erosion and compaction problems also are not new to the area because of the dryland agricultural activity that presently exists. Between 20 and 40 percent of the total by-pass tract area is annually left bare of protective cover due to summer-fallowing. These conditions will continue with or without the presence of an active mine.

In mining the existing leases, some instability problems would probably appear with the onset of reclamation. Areawide settling, localized subsidence or collapse, and underground erosion or piping could occur (Groenwald, 1980). The extent of these problems would depend on the planning and implementation of a concerted reclamation effort (Power, 1979).

Intermixing of calcareous horizons would increase the salinity of the soil and make reestablishment of vegetation more difficult. Special handling of overburden, which would increase the cost of mining, may be required. The salinity problem should be resolved in a mining plan after more data have been collected and analyzed.

North Dakota law does not allow the transfer of soil material from one landowner to another, and unless a consenting landowner agrees in writing to waive this requirement, his land must be reclaimed with soil originally removed from his land.

Preliminary indications from completed and ongoing research by such agencies as the Science and Education Administration—Agricultural Research (SEA-AR) of Mandan, North Dakota State University—Agricultural Experiment Station (NDSU-AES), Montana State University and the Reclamation Research Unit at Bozeman, Montana, are that agricultural productivity of mined land can be restored.

Farming and Ranching Agricultural Operations

Agricultural operations in the region consist of livestock, cropping, or small grain and livestock operations. Dryland farming methods, most notably alternative year summer fallow-cropping rotations, are widely practiced. Small areas, mostly haylands, are irrigated. Crops include hay, spring wheat, durum wheat, winter wheat, oats, barley, and corn. Much of the cropland production, especially the wheat portion, is sold as a cash crop. Oats, barley, and corn are also used as feed grains in livestock operations.

National prime farmlands as computed from designated soils series (SCS Order II surveys) constitute 20,559 acres or less than five percent of total tract acreage. Total prime farmland disturbance would involve six percent of the Fort Union region's prime farmland. Farmlands of statewide importance include another 116,550 acres or 32 percent of the region's tract acreage.

Native rangeland is classified as a Mixed Grass Prairie type (Shaver,J.C., 1977). This includes species such as needle and thread, little bluestem, prairie sandreed, western wheatgrass, blue grama, side-oats grama, plains muhly, sedges, fringed sagewort, and silver sage.

No threatened or endangered plant species, as published in the 1980 federal list, have been identified within the tracts.

Woody draws populated with native trees and shrubs are interspersed among the tracts, particularly within the North Dakota portion of the region. Shelterbelts and field windbreaks also were recorded.

Wetlands, specifically prairie potholes, have been identified from SCS soils maps and high-elevation color infrared photography.

Wheat yields average 25 to 28.7 bushels per acre, based on long-term average production figures obtained from county offices of the Agriculture Stabilization and Conservation Service (ASCS). The variation is largely a result of moisture availability extremes from west to east across the region.

Hay production ranges from 1 to 1.95 tons per acre on non-irrigated tract acreage in the region; however, irrigated haylands on the Dunn Center tract average 5 tons per acre. Three hundred and eleven tract acres of cropland are under irrigation in the Dunn Center tract.

Hay production averages from one to two tons per acre with irrigated hayland in the Dunn Center tract averaging five tons per acre.

Lands annually laid bare throughout the entire year due to summer fallow practices in dryland farming constitute 13 percent (53,700 acres) of the total tract acreage.

Rangeland produces an average of .195 to .6 AUMs per acre (an Animal Unit Month is the amount of forage needed to support a cow/calf for one month). Beef cattle are the predominant kind of livestock. There also are some dairy cattle, hogs, and sheep.

There are 511 operators and operator partnerships within the tracts, and fifty-five percent of tract acreage in the region is farmed or ranched by owner/operators. Forty-five percent is farmed by 339 lessees or operators who do not own the land. The total tract acreage constitutes 27 percent, on the average, of the total operations of the 511 operators and operator partnerships. The additional 73 percent of their operation acreage is located primarily adjacent to the tract acreage.

Of the 511 operations, 347 are primarily cropping operations, 36 are livestock operations, and 128 are classified as mixed cropping and livestock enterprises.

The mining period for each of the existing mines varies from 40 to 52 years with a ten to fifteen-year reclamation period. Based on concurrent disturbance on all tracts, peak mining operation disturbances have been analyzed on an annual peak disturbance basis. During peak years, 19 to 25 percent of individual tract acreages would be displaced from agricultural use.

Concern has been expressed over the agricultural production losses that is displaced when coal is mined, and expressing such losses in dollar terms enables us to gain more perspective in judging their significance.

All of the operations have less than the peak mining acreage within the respective tracts; therefore, it is possible that each of these operators could have all of their land within the tract out of agricultural production at some point in the life of the mine.

The impact of strip mining on the operation and management of livestock ranches could be more severe than on dryland farming because mine development located near the center of a ranch could seriously interfere with movement of livestock, fencing and pasture arrangements, livestock water supplies and distribution, and in general disrupt the overall operation.

Strip mining could interfere with livestock movement and generally disrupt the overall operation.

Compensation to the farm/ranch operator would vary depending on the type of landowner lease, lease ownership pattern, and percentage of land owned versus leased. New surface leases that are presently being signed could result in compensating landowners up to $1500 per acre if grazing land is involved. This compensation would occur over a period of time and would result from rental, bonus, royalty, and damage payments. Older leases were signed for as low as $1 per acre annual rental with 2¢ per ton royalty rate to surface owners. Under these terms, compensation could average from $260 to $525 per acre within the tracts delineated in this alternative.

Operators that have only lease land within the tracts would not be compensated for the lost leases. Loss in income within the seven mine areas, however, would be less than the overall tract averages of $8.65 to $15.67 per acre annually. Lost income would be the profit that is now being realized from the lease after the rent is paid.

WILDLIFE

Wildlife and Wildlife Habitat

The prairie pothole area of North Dakota, Canada, and parts of Montana is part of the primary waterfowl producing portion of North America. Stock ponds and dugouts are also important for breeding ducks in the Fort Union area, and these water bodies become increasingly more important during drought years (Altop 1982).

The area covered by the tracts does not produce as many waterfowl as pothole areas to the North and East due only to the smaller number of wetlands. Any high quality wetland is a significant resource, and the importance of an area to waterfowl production simply increases as the numbers of wetlands increase and as wetlands are destroyed elsewhere. The Fort Union Coal Region includes some of these valuable wetlands. Since the majority of the birds in the Central Flyway, from Canada, through the U.S., and into Mexico are produced in the prairie pothole region, the waterfowl that are raised on these areas are of national and international importance.

The pothole region of North Dakota is important in waterfowl production

Farming is prevalent in most of the Fort Union region in both Montana and North Dakota, but some fairly large areas of native prairie still exist. Other valuable wildlife habitat occurs wherever the drainages are deeply dissected and form rough breaks, buttes, and gullies. The most valuable wildlife habitat occurs where riparian areas, woodlands, wetlands, native prairie, and rough topography occur together with interspersed farm land.

White-tailed deer rely on the riparian areas, woody draws, and larger windrows. Winter survival, escape cover, and fawning areas are all critical items necessary for the survival of white-tails.

Mule deer are generally found in areas of broken terrain interspersed with hardwood draws and grasslands. In the winter hardwood draws and riparian bottoms are crucial for the survival of mule deer. In eastern Montana, these hardwood draws and riparian areas provide essential water, shade, and succulent vegetation not available elsewhere.

Mule deer in western Montana

In both Montana and North Dakota crucial sharp-tailed grouse habitat occurs where large areas of native prairie are interspersed with shrubby coulees and hardwood draws. Residual cover in mesic areas on north slopes for nesting complete the essential habitat for viable populations.

Rolling terrain marked by depressions, ridges, flats, benches, and some breaks form the essential prong-horn antelope and sage grouse habitat in western North Dakota and eastern Montana. Sage-grassland with a mixture of big and silver sage, rose, snowberry, and rabbitbrush with an understory of forbs in spring and summer are the items making these areas important for these two species.

Pheasants are a very important game bird and are tied almost exclusively to agriculture and heavy cover generally near or in stream channels.

Turkeys are restricted to the rugged, open ponderosa pine forests with small, grassy openings and brushy drainages, generally near agricultural land. In the winter they are found in lower drainages of deciduous cover or near farms and ranches.

The fisheries resources in the Fort Union area are limited to Fort Peck and Sakakawea Reservoirs and a few small streams, namely, the Redwater River and Nelson, Timber, and Upper Seven-Mile Creeks. The shallow bays in the large reservoirs provide spawning and nursery areas for sport, forage, and commercial fish. The Redwater River contains walleye and northern pike which provide sport fishing for the local residents. A small population of northern pike occur in Upper Seven-Mile Creek.

The woody draws and broken terrain identify valuable wildlife habitat

Threatened and Endangered Species

Endangered animals which migrate through the Fort Union Coal Region include the bald eagle, peregrine falcon, and whooping crane. Whooping cranes adhere strictly to ancestral breeding grounds, migratory routes, and wintering areas. Central and western North Dakota are in the migration route of the last remaining wild flock of whooping cranes, and although no whooping crane critical habitat occurs in the Fort Union region, they do stop over periodically during migration. They are capable of sustained flights at high altitudes and can overfly obstructions and areas of drought or low food availability. The majority of whooping crane sightings are outside the tracts; however, the Garrison and Underwood tracts are closest to the areas of the majority of sightings and are included in all alternatives. One whooping crane was sighted on the South Wibaux-Beach tract in 1979 when heavy spring run-off flooded the temporary wetlands (W. Mathews, personal communications).

Black footed ferrets have not been found on or near any of the coal tracts in the Fort Union Region, and there are

TABLE 2-8
North Dakota Game and Fish Department License Sales and Population Information.

	1970		1980		1970-80 % Change	
	Mercer County	North Dakota Total	Mercer County	North Dakota Total	Mercer County	North Dakota Total
Human Population	6,175	617,791	9,378	652,695	+52	+6
General Game*	634	82,107	1,706	88,807	+169	+8
Resident Deer Bow	21	3,478	153	9,761	+629	+181
Resident Furbearer	116	7,152	745	32,043	+542	+348
Resident Single Fishing	525	30,237	1,278	48,265	+143	+60
Resident Family Fishing	705	32,509	1,255	41,555	+78	+27
All Comparable License Totals	3,776	252,354	8,234	1,442	+117	+35

*Requisite for purchase of most hunting licenses and generally purchased in the county of residence.
Source: North Dakata Game and Fish Department.

no known nesting, concentration areas, or other important habitat for peregrine falcons or bald eagles on any of the tracts.

Increased hunting and poaching is already a problem where coal development has taken place (see Table 2-8). In Mercer County, it is estimated that game violations have increased 200-300% over the past 8-10 years since coal development has taken place, with the influx of construction and mine workers as the primary reason (K. Sambor, personal communications).

The Dickinson and Miles City BLM District offices have initiated consultation with the U.S. Fish and Wildlife Service in conformance with Section 7 of the Endangered Species Act. During this process, no irreversible or irretrievable commitment of resources will be made that would preclude the formulation of reasonable and prudent alternatives for the preservation of threatened or endangered wildlife species.

CULTURAL FEATURES

Prehistoric Features

Three hundred and thirty-four archaeological sites have been recorded from the tracts under consideration for lease in the Fort Union coal region. Of these, 245 sites are prehistoric and 89 sites are historic. A cultural resources technical report outlines this history and prehistory.

Briefly, the first well-documented human use of the Fort Union region was by Paleo-Indian cultures until 7,000 B.C. (Willey, 1966). These people were followed by Archaic cultural groups who subsisted here until approximately A.D.500 (Willey, 1966 and Lehmer, 1971). Late prehistoric people followed the Archaic groups and were in the region when Euro-Americans contacted them sometime after 1740 (Lehmer, 1971).

Paleo-Indian people probably based their subsistance on hunting big game. The Archaic people continued hunting, but added the utilization of wild vegetable foods to their subsistance stratigy. The Late Prehistoric lifeway became even more diversified. Big game hunters on the plains existed with farmers in earth lodge villages along the Missouri and Yellowstone rivers.

It is difficult to tie known archaeological sites from the various tracts to these prehistoric time periods. Too little testing and evaluation has taken place. However, frequency of site types and the few available diagnostic artifacts fit the kind of situation just outlined.

Lithic scatters are one frequent site type that illustrates the human use of the Fort Union region (see Table 2-9). They account for 59% of the prehistoric sites known and are assemblages of stone material that has been worked by people. These are the kind of sites that result from the production of tools used for hunting and other subsistance activities.

Stone circles, sometimes called tipi rings, are another frequent kind of site that illustrate human use in the region. They account for 18% of the known prehistoric sites and are believed to have been anchor stones holding down the skin tent or tipi of nomatic plains dwellers. Like lithic scatters, stone circles are difficult to evaluate because the information they contain may be scanty and difficult to analyze.

Nine stone circle sites with associated cairns, alignments, and rectangular depressions have been recorded on the Renner and Glenharold tracts. This kind of association adds to the information potential and understanding of stone circles making these sites important to the understanding of prehistory.

TABLE 2-9
Fort Union Region Known Cultural Sites by Type

	Lithic Scatter	Stone Circle	Stone Circle With Other Features	Other Habitation	Buried Site of Unknown Function	Stone Alignments and Cairns	Lithic Procurement and Cache	Homestead	Historic Refuse	Historic Mine	Historic Burial	Historic Limited Use Area	Total Sites
Bloomfield	13						2						15
Burns Creek	13			1									14
Central Bloomfield	13						2						15
Circle West I	4							2					6
Circle West II	3					3	1	1				1	9
Circle West III	7					3	1	3				1	15
North Wibaux-Beach	4						4	10	5			1	24
Redwater I	3							2				1	7
Redwater II		2			1			4					7
South Wibaux-Beach	10							10	6	1		1	28
Southwest Glendive	1												1
Antelope		9				2							11
Center	1	2											3
Dunn Center	52	1	1			2	10	3	1				70
Garrison													1
Glenharold	20	12	1	13	1	4	2	3		3	1		60
North Beulah		3											3
Renner	4	14	7					8			1		34
Sakakawea		1											1
Schoolhouse	2	1						1	1				5
Truax													
Underwood		1							1	1			3
Werner	4						3	5					12
Zenith	3							5	3				11
Woodson PRLA (Alt. 3)	4					1		1					6
Meridian (Alt. 3)	4						1	2				1	8
BLM (Alt. 3)	7						1	2	1		1	5	17

There are several tracts with archaeological site assemblages different than the lithic scatter/stone circle pattern just described. In the seven production maintenance tracts, only 25% of the sites are lithic scatters while 37% are stone circles. The percentage of other habitations (11%) is also higher than the region.

Most typical of this situation is the Glenharold tract. In addition, it contains the greatest range in site types, and these include lithic procurement sites where people gathered stone for the manufacture of tools and stone alignments and cairns that may have had a number of functions including ceremonial uses. Little understood mound sites have been recorded in the immediate vicinity of the tract.

The Glenharold tract takes on its significance from several facts. First, it is close to the Missouri River Valley, an area which contained a large prehistoric population. Second, it is an area of topographic diversity including grassy uplands and wooded draws. These two factors combined to give the prehistoric people an area where a wide variety of activities important to their lifeway could take place. The Glenharold tract is located in what little remains of the Missouri River Valley that has not been flooded by major reservoirs and it is critical to understanding the prehistory of the region.

The Dunn Center and Werner tracts also differ from the regional pattern of site types. The Knife River Flint Quarries located on these tracts are of national significance in understanding prehistory. This fact has recently been recognized by the keeper of the National Register of Historic Places. A district of 9900 acres (see Dunn Center Tract Map, Chapter 1), including many quarries and sites associated with them, has been determined eligible for the National Register of Historic Places. Material from these quarries was used as a major toolmaking material not only in the Central and Northern Plains but east into the Ohio River Valley and north into Canada. This use began early in the Paleo-Indian period and continued through the prehistoric record, a time range of over 10,000 years.

Not all of the known Knife River Flint Quarries are located in the National Register Eligibility District or on the Dunn Center and Werner tracts. They cluster in southwestern North Dakota from central Dunn County east into Mercer and Oliver Counties. However, the quarries in the vicinity of the tracts are the largest and most concentrated of these sites.

Lithic procurement sites have been identified on the Beaver Creek Divide on the North Wibaux Beach tract. These sites represent the collection of porcellinite for use in the manufacture of stone tools. While the sites are unique on the Fort Union tracts, they are not unique in the region as illustrated by the large number of lithic scatters that occur on the tracts in the western portion of the Fort Union region. Frequently these western sites

cluster along divides between drainage systems and on features of higher elevation.

Historic Features

Knowledge of historic sites on the tracts throughout the Fort Union region is hampered by a lack of inventory. Many archaeological survey efforts have not recorded these cultural resources. This situation has been corrected in recent surveys that have specifically required the recording of historic features.

The historic record for the region can be divided into three periods. From about 1740 and ending about 1860 the area was influenced by explorers and the fur trade. These efforts focused on the Missouri River with some attention given to its tributaries and the uplands adjoining it. Historic sites from this period are not presently known to be found on any of the tracts and would therefore be very important.

Military activity and the subjugation of the Indians is the next historic period in the region. From about 1860 to about 1880, army units operated over the area from major forts along the Missouri and Yellowstone Rivers. Battlefields are known from the region but not from the tracts. Historic sites from this period are not presently known to be found on any of the tracts and would therefore be very important.

The last historic period in the region follows the military activity and ends about 1920. This is the homestead and settlement period that has left indications of human activity across the region. Seventy percent of all historic sites so far recorded are homesteads, and most of the remaining sites are refuse left behind by the same people.

Homesteaders came to the Fort Union region as agriculturists. In addition to homesteads and their associated trash, these people have left behind machinery, irrigations works, coal mines, schools, and cemeteries as well as other remains of their efforts at subsistance. An evaluation of these physical remains is an invaluable addition to the historic record.

OTHER LAND USES AND VALUES

Land Use, Utilities and Transportation

The character of the Fort Union region is primarily agricultural. In Montana a greater portion of the land is dedicated to livestock grazing and less to cropland than in North Dakota. A large area roughly centered around Stanton and Hazen, North Dakota (see the Draft West Central North Dakota Regional Environmental Impact Study on Energy Development) has been altered through the development of coal. The land has been consumed by strip mining, reclamation, power plants, transmission lines, ancillary facilities such as roads, and residential and commercial growth in the local towns. Stress has been placed on local communities and their services and transportation systems have received more use.

This transmission line in eastern Montana is similar to those found throughout the region

The transportation system of the region consists of one interstate highway (I-94), two-lane black top roads, numerous gravel and dirt roads, the Burlington Northern Railroad, and numerous small airports. Interstate 94 and the railroad are used for interstate commerce and as the major conduit for agricultural products from the region. Other surface transportation systems are used primarily for access to farm and field and to connect the small communities. In Montana the two-lane black top secondary roads are spaced irregularly approximately 50 miles apart. In North Dakota roads generally follow section lines, as each section line is a dedicated right of way. Virtually all of the roads in the region are under utilized. Most are maintained adequately for existing use. In areas of existing coal development some traffic congestion occurs during peak hours.

Typical traffic volumes in the Fort Union region are shown on the tables for the various alternatives. The capacity of a highway is generally about 2,000 vehicles per hour for a two lane road. Traffic figures are expressed in AADT or Average Annual Daily Traffic and are taken from the Montana Traffic by sections for 1982 and the North Dakota Traffic Report for 1979. None of the highways studied appear to approach capacity and should be adequate for the foreseeable future. No projections were made for baseline traffic information. Peak load for the baseline was figured at 8%, based on North Dakota traffic distribution studies.

Aesthetics

Southeastern Montana and Southwestern North Dakota are generally agricultural in character. The aesthetic value of these landscapes is high, but the vast character of rolling countryside with little relief and the predominantly low, uniform vegetative cover has little to attract the observer as scenery. The smallest of vertical features gains significance in these landscapes because of the dominantly horizontal aspect of the region. Patches of trees and areas of badlands within the region, while not dramatic if placed in a landscape with more variety, are very important in this context simply because they offer visual relief from monotony. These features have become highly valued because of this.

Rural landscape typical of the region

The rural nature of the landscape has been altered dramatically in portions of North Dakota through coal development and the plants erected for producing energy. Producing strip mines are less noticeable than the large plant buildings, smoke stacks, and draglines. Reclaimed areas need to be pointed out to be noticeable to the casual observer and spoil piles are temporary features in a changing landscape.

The buildings, smoke stacks, and utility lines, as large, vertical features in a predominantly horizontal landscape, dominate vast areas and color the observers perception of even larger areas. The perception an observer has of an area is in terms of a collection of impressions rather than as a total picture. The observer is aware of the presence of, for example, a power plant even though the view is temporarily screened by an intervening hill or copse of trees.

At the present time the mining and processing of coal influence the observer's impression of 4,800 square miles in North Dakota. Energy transmission lines reinforce this impression over much larger areas.

RECREATION

Eastern Montana residents enjoy a variety of outdoor recreational activities which can be used as a guide for those specific counties impacted with proposed coal development.

In a recent survey (Wallwork, 1980), residents enjoyed approximately the same level of interest as the rest of Montana in four-wheeling, birdwatching, boating, pleasure driving, fishing, and picnicking. Generally there is less involvement with bicycling, camping, skiing, hiking, outdoor swimming, outdoor games, river floating or canoeing, and pleasure walking. There is more involvement in hunting, motorbiking, snowmobiling, and some rockhounding.

For the most part the limited time available for recreational participation is a major factor as well as consideration for the expense involved, and the fact that many recreational activities are not available in eastern Montana. Another consideration is the health and age of potential participants. They are generally well satisfied with existing recreational services and programs and do not want to eliminate or add any. This also applies to having new or expanded State recreational sites.

Preferred fishing locations are split between streams or rivers and lakes or reservoirs, and residents are evenly divided on whether there are enough fishing access areas. There are a significant number of landowners that have had problems with recreationists.

Community recreation facilities in the Montana counties most likely to be impacted by coal development are generally suited to satisfy the present demand and are considered adequate or barely adequate.

Richland, Dawson, and Wibaux counties are considered through the middle 1990's to have barely adequate or adequate recreational facilities. McCone County and Sidney in Richland County project inadequate recreational facilities through the 1990's.

In the west-central region of North Dakota, as in eastern Montana, a wide variety of outdoor recreational activities are enjoyed by the residents. There is general interest in hunting upland game and waterfowl, playing tennis, power boating, swimming at the beach, and horseback riding (West-Central Regional EIS, 1978). Generally there is less involvement in big game and predator hunting and hiking. There is greater involvement with golf, ice skating, baseball/softball, snowmobiling, camping, fishing, and picnicking. There is less involvement with canoeing and more in pool swimming. Theodore Roosevelt National park is centrally located in the region and had 603,210 visits in 1980.

Community recreation is a highly ranked community goal with facilities rated as average to moderate in importance. The residents registered some dissatisfaction with the existing facilities in the latter 1970's with a

present determination of adequacy by the regional/community planners as adequate or barely adequate. South Heart was considered to have inadequate community recreational facilities.

Through coal-related growth and the grants received to accomodate the growth, Mercer County has received for recreation 4.8 percent of the total grants from 1975 to 1981 (ITAT, 1982). These grants were from the Coal Impact Office, Federal Highway Administration, Heritage Conservation and Recreation Service, Corps of Engineers, and the Farmers Home Administration 601 Program. These grants have enabled the recreational facilities to be upgraded in the same time frame as other basic community services.

ECONOMIC CONDITIONS

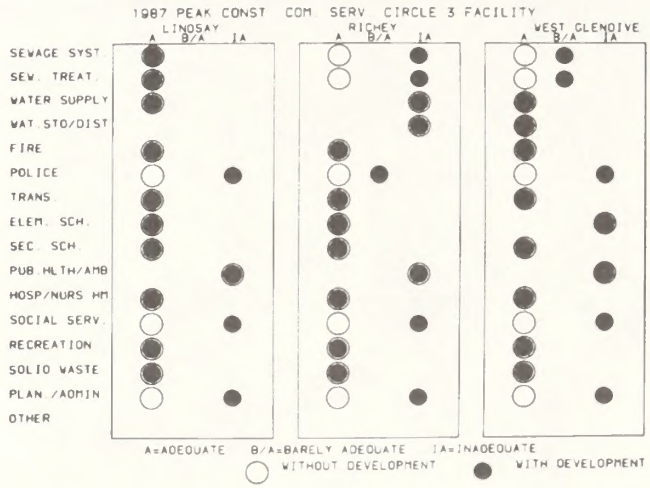
The economic character of the Fort Union study area is primarily agricultural with small, rural communities typical in the area. Bismarck, Mandan, Dickinson, Sidney, and Glendive are the largest communities in the study area and serve as area trade centers. Many of the smaller communities in the study area have experienced declining population and workforce levels as residents move to the larger communities in the area in search of better services, educational opportunities, and jobs. Virtually all of the nonagricultural jobs to be found in the study area are located in the communities mentioned above. The broader economic base found in these cities allows for a much broader range of employment sectors.

Current and forecasted population levels through the year 2005, without Fort Union coal development, can be seen in Chapter 3, Figure 3-2 (and associated Appendix G). As these graphics show, many of the communities expected to receive population growth from Fort Union coal development are expected to grow somewhat over time, even without the coal development. This growth is related primarily to the oil and gas activity in the Williston Basin. Those communities which are forecasted to lose population in the future are also those which would not experience growth in employment opportunities during the long-run.

The 1981 community service adequacy ratings for the communities in the Fort Union study area appear in Chapter 2 of the individual Site Specific Analyses (SSAs). Figure 2-7 shows an example community service adequacy graphic which is typical for the area in that most of the communities currently have several services in an inadequate category. The SSAs show the 1981 adequacy ratings for those communities which are assessed in Chapter 3.

Current business activity and current personal income in the study area are mainly comprised of mining, agriculture, and wholesale/retail activity. Both personal income and business activity are expected to increase gradually in the region in response to long-term economic growth in both eastern Montana and western North Dakota. With the exception of the larger trade centers in the study area, most counties and communities have experienced some fluctuation of personal income in the past as the result of the relative dependence on the agricultural trade which is susceptible to wide swings in output and prices.

FIGURE 2-7



SOCIAL CONDITIONS

Mercer, Oliver, and McLean counties have undergone major changes in their social makeup or organization in the recent past because of coal related development within the region. The successful integration of large numbers of energy workers into communities in these counties, as well as in nearby Bismarck-Mandan, has expanded the social and cultural bases of the towns and has provided a more diversified economy for the area as a whole. Because of this growth, many of the social processes and structures and the administrative experience necessary to deal with development issues already exist in these communities.

In Stark County and parts of Dunn County in North Dakota and in Richland and Dawson Counties in Montana, oil and gas activity has caused small population booms in the last decade that have led to expansion of their economic and social environments. The activity has been concentrated primarily in the communities of Killdeer and Dickinson, North Dakota, and Glendive and Sidney, Montana. This oil and gas related growth has hastened the transition to a more complex adminis-

trative and governmental structure in these communities and has, in general, accelerated trends toward a more urbanized environment.

Mobile home parks like this one in Glendive are relied on where the housing supply is limited. Photo courtesy of the Glendive Ranger-Review.

In the remainder of Dunn County and in Golden Valley County in North Dakota, and in Wibaux and McCone Counties in Montana, some peripheral oil and gas-related growth has occurred but not enough to alter the predominantly agricultural character of these areas. The communities in these counties have shown stable or declining growth patterns in the past with high concentrations of people in the 65 years and older age category. The political and administrative structures of these communities is still informal and relaxed.

In all the affected communities including those which have undergone major population increases in the last decade, the predominent form of community interaction is most often described by residents as informal and personal. According to surveys conducted in the recent past (BLM 1978, 81, 82; REAP 1979), the small town atmosphere, the quiet, predictable pace of life, the friendly social environment, and the mutually supportive networks of family and friends are the community attributes most widely appreciated by residents of the area. In the smaller communities of Circle and Wibaux, the lack of crime and other stresses is also frequently cited as an aspect of their communities which make them particularly attractive places to raise a family or retire.

Residents in small towns in eastern Montana and west-central North Dakota are, according to the same surveys, generally satisfied with the level of services which their communities offer. The services which are most frequently mentioned by respondents as being deficient in their communities are shopping opportunities, recreational facilities, medical services, and jobs. For instance, rural communities in the Ft. Union region have traditionally had problems attracting and keeping trained medical personnel, especially doctors. Residents are thus either forced to or choose to travel outside their communities when seeking medical services, usually to larger cities in the region such as Bismarck, Dickinson, or Miles City. Although many of the communities within the Fort Union region have hospitals, use rates are low which, in turn, has limited the level of personnel and services the facilities can support.

In both North Dakota and Montana, the current level of demand for services such as short-term emergency public assistance and family counseling is threatening to exceed the ability of local providers to respond and is putting severe strains on county and state budgets. Further aggravating this situation in eastern Montana is the fact that some counties such as McCone and Wibaux must share social service personnel with other counties. In addition, centralization of services such as alcohol and drug treatment and mental health counselling in large urban areas creates special problems for residents of rural areas who may wish to utilize these services but lack travel time or transportation to do so.

Demands to Zap's services and facilities were handled by Energy Impact Office monies, including renovations to Zap's community hall at center of picture. Photo courtesy of the Beulah Beacon.

The adequacy of law enforcement personnel and equipment varies by county (see Chapter II of the SSAs). Generally residents of rural areas which have undergone rapid population fluctuations and some degree of social disorganization report lowered perceptions of personal safety, and thus view law enforcement as a high priority item. In communities where the major activity has been oil and gas related, the high turnover of workers and increases in other problems associated

with these workers have left many long-time residents suspicious and wary of outsiders.

While it appears that a large segment of the population of the region favors some level of energy development, residents often qualify this approval (BLM 1978, 81, 82; REAP 1979). Concern for the protection of agricultural lands and some guarantee of reclamation potential are frequently listed as prerequisites for approval. Job opportunities generated by development and expansion of local economies are most often cited as reasons for favoring coal development. Many residents, of smaller communities in particular, are concerned about the health of their local business centers and would like to see the economic base of the area expanded to add a buffer for years when agricultural production is down.

Traffic congestion occurs during the shift change at the Antelope Valley and Great Plains Coal Gasification Plants in North Dakota. Photo courtesy of the Beulah Beacon.

As a group, the residents of the rural portions of affected counties are more apt to express opposition to development. Their concern for the conservation of agriculture and the protection of air and water quality both on and off-site is often very strong. In addition, negative impacts of development such as increased population levels, crowding of schools and increased incidences of crime are frequently given by small town residents as reasons for opposing coal leasing. Opposition to coal development is often attributed to past poor relations between coal companies and local landowners in the region.

The social structure or organization of the Fort Berthold Indian Reservation has remained relatively unchanged by past energy development activity in the region (West Central Regional DEIS, BLM, 1978). Cultural traditions shared by the Mandan, Hidatsa, and Arikara tribes are still intact, and much emphasis is placed on preserving

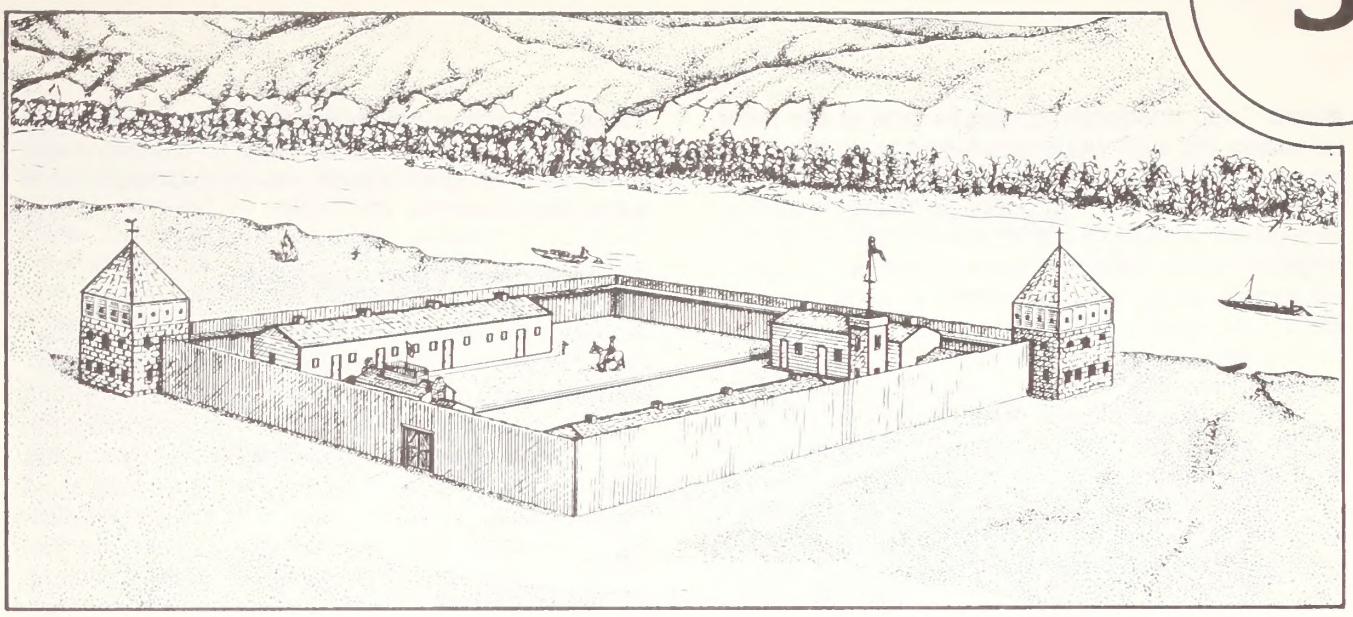
Two additions to this elementary school in Beulah, North Dakota, were funded with Energy Impact Office monies. Photo courtesy of the Beulah Beacon.

the future cultural integrity of the tribes. Extended family networks and religious affiliations are both very strong characteristics of the social and cultural environment of the tribes.

Social services on the reservation are generally adequate to serve the needs of the tribal members. Health services, social services, and law enforcement services are all managed by agencies on the reservation although use of hospital facilities are handled through contractual agreements with the Hazen facility.

Tribal attitudes toward energy development appear to be cautious (West-Central North Dakota Regional DEIS, BLM, North Dakota 1978) with strong sentiment in favor of protecting air quality and the tribes' cultural integrity. Jobs in energy-related developments are currently a high priority for Indians on and off the reservation. Statewide training programs are operating in Bismarck to help Indians obtain future employment on these developments.

CHAPTER 3



ENVIRONMENTAL CONSEQUENCES

The discussion which follows has been guided by the major issues identified to date through public comment and local, state and other federal agency concerns. These issues have been used in tract ranking and the preparation of the alternatives by the Regional Coal Team. Other resources, while not identified as critical issues, have been included for general public information. These resources are land use, aesthetics, and recreation.

AIR QUALITY

Major Air Pollutants

Air pollutants will be emitted into the atmosphere as a direct consequence of the project. The environmental consequences of these air pollutant emissions will be varied and complex. The direct consequences related to each tract have been analyzed and reported in the individual site specific analyses (September 1981).

Evaluation of cumulative regional effects requires more complicated analysis including advanced computer modeling, and this evaluation is under way but not yet complete. This section of the Draft EIS is incomplete and preliminary, but it will be completed and a special air quality impact analysis report will be issued in late August, 1982 for public review and comment. The computer modeling analysis will evaluate the cumulative effects related to the major pollutants, including projected ground level concentrations of those pollutants as related to state and federal air quality standards and increments pertaining to prevention of significant deterioration of air quality. Effects on visibility will also be analyzed.

Other cumulative effects related to air quality will be analyzed to the extent appropriate to current knowledge.

Acid Precipitation

The effect of the project in relation to acid precipitation is a problem of particular concern, but the current state of knowledge on this problem is not sufficiently developed to permit precise quantitative or even reliable qualitative prediction of project consequences.

The current state of knowledge has identified acid rainfall as a serious and growing problem in some parts of the world, and intensive studies are underway to gain an understanding of the causes and effects of acid rain and how to mitigate it. There is a growing mass of data but serious disagreement and controversy in interpretation.

Because of the disagreement and controversy and the potentially serious nature and extent of the problem, the U.S. General Accounting Office recently made an investigation of the subject to try to identify what is presently known and what is uncertain. In its report, "The Debate Over Acid Precipitation-Opposing Views-Status and Research" (U.S. General Accounting Office, September, 1981), some areas of knowledge and agreement are described, but most of the significant issues were reported to be in disagreement. The report

stated: "acid precipitation may be one of the most polarizing yet least understood energy/environment issues of the 1980s. Its implications for environmental quality and national energy policy, particulary regarding increased coal use as a substitute for imported oil, may be profound . . . Major questions concerning acid precipitation's alleged environmental impacts relate to effects on aquatic and terrestrial ecosystems, man-made materials such as statuary, metal and finishes, and human health. Damage to aquatic ecosystems is one of the areas of highest consensus among interest groups debating the phenomenon. Acid precipitation's environmental impacts in the other areas are less understood and quantifiable . . . The debate over the effects of acid precipitation has been paralleled by an often heated debate over its causes."

Based on current knowledge there can be little doubt that emission of sulfur and nitrogen oxides by project sources at the rates shown in Table 2-2 will contribute acidity to atmospheric deposition.

Studies to date in the north central U.S. show that there is no current acid precipitation problem in or near the Fort Union Coal Region. They show, for example, that precipitation in western North Dakota has an average pH of 6.0 (West Central North Dakota EIS, Final, 1978, p. 67) and in central Montana it rises to 6.5, indicating very low acidity in both North Dakota and Montana.

Although project emissions will probably cause some increase in precipitation acidity, whether the increase will be significant and where it may show up geographically cannot be predicted. Some of the acidity will likely be deposited in the Fort Union Coal Region, some of it will probably be carried into surrounding areas, and some of it may be transported to distant parts of the continent or of the globe. For these as well as other reasons, the environmental consequences cannot be easily predicted.

If significant acid precipitation does occur in the Fort Union Coal Region or nearby areas, there are two geological factors which offer some degree of protection against its adverse effects. One of these is that soils are generally deep in the region, and they have considerable capacity to buffer acidity. Thinness of soil cover is one of the important factors in the acid rain problem in the northeastern U.S., contributing to the sensitivity of that region to acid precipitation. The soils in the Fort Union area tend to be alkaline and have a greater capacity to neutralize acidity than the non-alkaline soils of the northeastern U.S. Airborne soil dust is, in fact, believed to play some part in neutralizing precipitation acidity, particularly in the summer.

The Fort Union Coal Region thus appears to have a fairly low potential for adverse impacts due to acid precipitation. However, much more knowledge of the phenomenon is needed, and both Montana and North Dakota, as well as the federal EPA, have monitoring programs and studies under way to develop more information so that impacts can be evaluated more adequately.

Deposition of Trace Elements

Although the major constituents of coal are carbon-containing compounds, there are minor or trace quantities of many other elements and compounds in coal. When coal is burned, these trace chemical species are emitted from the combustion chamber along with the combustion products in the form of either vaporized compounds or particulate solids. In modern facilities equipped with efficient emission control devices required by air quality regulations, a very high percentage of particulate emissions are captured and not emitted into the environment. However, large scale operations such as envisioned for the Fort Union coal leasing program could result in particulate emissions, as shown in Table 2-2, with consequent dispersion into the atmosphere of the trace elements in the coal. The question must therefore be considered, how will the dispersion of these elements affect the environment? The importance of the question is underscored by the fact that some of the trace elements in coal may be toxic to life forms.

To provide information leading to answers to this question, the North Dakota State Department of Health recently initiated a series of studies on the subject, and they found that lignite coals of the Fort Union Coal Region contain 15 trace elements in the concentrations shown in Table 2-3. Most of these elements are toxic to some degree in some circumstances, while some of them are beneficial to life processes under certain circumstances. The North Dakota study of the deposition of these elements in the soils near coal-fired electric generating stations indicated that the rates of accumulation of the elements in the soils are relatively minor as compared with the quantities already present in the soils. This information led to the conclusion that the deposition of trace elements from the development of energy resources in west central North Dakota would not be expected to cause adverse effects on ecosystems during the short term period encompassed by their phase one study (one year). However, no conclusions could be reached regarding the long term effects and it was therefore recommended and planned to continue the studies. Further details of the phase one study may be found in the West Central North Dakota Regional Environmental Impact Study on Energy Development and associated documents (1978). The same conclusions and caveats apply to the Fort Union Regional EIS.

Deposition of Radioactive Elements

A sub-category of trace elements in coal which are of special concern is radioactive elements. Although these elements are normally present in coal in extremely minute amounts, their presence is of concern because of the potential health hazards of radioactivity. Uranium and other naturally occurring radionuclides are found in all coals as they are in all parts of the lithosphere. The uranium content of representative Fort Union coal is shown in Table 2-3.

There is presently little information on the radioactive material content of Fort Union lignite coal other than uranium concentrations. The EPA has examined the question of radioactive emissions from coal combustion in a document entitled, "Potential Radioactive Pollutants From Expanded Energy Programs" (EPA-600/7-77-082, August 1977). Appendix F contains a projection of the emissions of radioactive material from five coal types in microcuries per day (microcuries, a unit of radioactivity describing the rate of decay of radioactive material). One microcurie equals 3.7×10^4 nuclear transformations per second. This projection involved a number of assumptions concerning the amount and distribution of radioactive material in the emission of particulate matter from a 1,000 megawatt power plant employing a 99.5% particulate collection efficiency.

The example shown for the Powder River coal type corresponds most closely with the Fort Union lignite coals. The Powder River Wyoming subbituminous coal used in this projection was 8,200 Btu/lb, 6% ash, with uranium and thorium concentrations of 0.7 and 1.9 parts per million, respectively. This compares to Fort Union lignite with 6,800 to 7,000 Btu/lb, 6.2% to 8% ash, with uranium and thorium concentrations of 0.83 and 0.77 parts per million, respectively (D.N. Baria, A Survey of Trace Elements in North Dakota Lignite and Effluent Streams from Combustion and Gasification Facilities). In contrast, the subbituminous coal from the Navajo Reservation of New Mexico, uranium and thorium concentrations are 1.2 and 4.8 parts per million, respectively.

Releases of radon gas (radon 222 and radon 220) from these five plants were also compared in Table 3-1 with the assumption that all of the radon in the coal exists in the stack without any removal or capture in the pollution control devices of the combustion facility. This is a maximum, worst case condition since some radon may be caught in the sulfur dioxide scrubbers and because radon 220 has a comparatively short radiological half life of 54.5 seconds. Radioactive half life is the time it takes a given radioactive material to decay to half its original radioactivity. Some radon 220 could be expected to decay to a particulate with subsequent attachment to ash particulate and be captured in the particulate pollution control device.

TABLE 3-1

Release of Radon Isotopes from a 1,000-MW Power Plant

	Radon Release (uCi/day)[1]	
Coal	Rn-222	Rn-220
Appalachia (bituminous)	3,140	1,870
Illinois-W. Kentucky	7,050	2,220
Powder River Wyoming (subbituminous)	2,980	2,720
Navajo Reservation, New Mexico (subbituminous)	5,000	6,500
Kaiparowits Plateau, Utah (bituminous)	2,260	1,670

Source: U.S. Environmental Protection Agency Potential Radioactive Pollutants Resulting from Expanded Energy Development (EPA-600/7-77-082) August 1977

[1]uCi/day is the abbreviation for microcuries per day.

Given the similar characteristics (previously described) of the Powder River subbituminous coal and Fort Union lignite coal, the projected radioactivity emissions from the burning of Powder River coal in a 1,000 megawatt power plant would approximate the burning of lignite coal in a Fort Union 880 megawatt power plant. A coal gasification plant would have similar particulate radioactivity; however, the radon component would probably be transferred to the synthetic natural gas. The gas loops in a gasification plant are, for the most part, closed.

The impact of radioactive emissions from Fort Union coal-based energy development in western North Dakota was analyzed by the North Dakota State Department of Health and reported in the West Central North Dakota Regional EIS on Energy Development (1978). It was concluded that the total radioactivity released to the atmosphere from energy conversion projects would be lower than naturally occurring radioactivity, and that radioactive impacts of energy development in that area would be very low.

While the total rate of coal conversion projected for the entire Fort Union region will be greater than that occurring in the west central North Dakota area, this latter area will be the area of greatest concentration of energy conversion within the Fort Union coal region. Therefore, if radioactive impacts are very low here, it can be concluded that they will be very low throughtout the Fort Union Coal Region.

Secondary Impacts Associated With Population and Economic Growth

Development of Fort Union coal resources will be accompanied by growth in population and the general economy of the region. This will mean more motor vehicles and more motor vehicle emissions of air pollutants, in particular carbon monoxide, hydrocarbons, nitrogen oxides, and lead.

Evaluation of the air quality impacts resulting from this growth depends primarily upon population growth projections. Detailed projections tied to current studies by the BLM with the use of an economic-demographic model. These projections will be used for evaluating the associated indirect air quality impacts.

Effects on Water Quality

Air pollutants can indirectly affect water quality since most pollutants emitted into the atmosphere return soon or later as deposition on land or surface waters. Some of the pollution undoubtedly moves into the upper atmosphere where it can remain for a long period of time before it is washed out.

Pollutants can enter surface waters directly or be transferred from land deposition by rain runoff. Pollutants can enter ground water by percolation of rainfall through the soil or from surface water reservoirs.

One means by which water quality may be affected is associated with acidity, as acidic rain water can dissolve and leach soil minerals and trace elements and transfer them to both surface and ground waters. Another means is that toxic chemicals and trace elements can enter surface water directly from pollutants in the atmosphere causing potential adverse effects on water quality.

The information necessary to quantify the effects of air pollution on water quality in the Fort Union Coal Region is not presently available. However, consideration of the foregoing discussions pertaining to acid precipitation and trace elements leads to the conclusion that indirect effects of the project on water quality in the Fort Union coal region resulting from air pollution will likely be insignificant. However, the effects on less alkaline waters outside Fort Union is unknown. The amount of SO_2 transported great distances from the Fort Union region is presently unquantifiable and the role that the SO_2 would play in acid rain makeup is undefined.

Effects on Weather

Large scale operation of coal mining and conversion plants has some potential for causing weather changes on a local, regional, or even global scale. Local or regional weather is likely to be influenced to some extent by the release of heat, water vapor, and particulates, which can affect albedo (the fraction of incident solar radiation which is reflected), humidity, temperature, and cloudiness, with resulting effects on precipitation and visibility.

Cloud and precipitation processes are sensitive to the number, size, and type of particulates in the air from which a cloud grows and precipitation results. In fact, the process of formation of clouds depends upon the presence of minute particles, called condensation nuclei, onto which water vapor can condense and form water droplets. In clean air, air without any solid or liquid particles, clouds would not form.

The microphysical and dynamical mechanisms leading to clouds and precipitation are extremely complex. Simply stated, an excess of very small particles may inhibit precipitation processes, additional extra large particles may enhance precipitation processes, and additional ice nuclei (particles which act as centers for collecting water vapor to grow ice crystals or which, when in contact with droplets colder than freezing, cause these droplets to freeze) may enhance the precipitation process, or any combination may occur.

Natural condensation nuclei include vegetative pollens, windblown soils, sea salts, volcanic ash, and meteoritic dust. Natural ice nuclei are primarily soil particles; about 1 in 10,000 atmospheric particles is an ice nucleus. Other sources of condensation and ice nuclei are the exhausts of motors, furnaces, industrial processes, and power plants. Particulate emission and conversion of gases to particles in the plumes of power plants can create active condensation and ice nuclei.

A study of weather modification potential of coal-fired power plants in areas near the Fort Union coal region was conducted in 1976 by the University of Wyoming Department of Atmospheric Sciences. The study involved the Jim Bridger plant at Rock Springs, Wyoming, and the Colstrip Unit One plant located at Colstrip, Montana. The Jim Bridger plant operates typically at 650 megawatts but is capable of producing 1,000 megawatts. The Colstrip Unit One plant was operating at about 250 megawatts during the study but is capable of operating at 360 megawatts. Both plants had electrostatic precipitators which were operating during the collection of data for the study. An aircraft equipped with instruments for measuring particles made several data gathering flights through the plumes of the two plants. The study emphasized an assessment of effects upon precipitation by particulates contained in the plumes of the two plants.

The study concluded that additional condensed nuclei may cause small effects (increases or decreases) in the limited region of the plume, but the effects are probably negligible compared to natural year-to-year variations.

However, the results of this limited study cannot necessarily be extrapolated to larger plants or interacting plumes of two or more plants due to the non-linear nature of the emission and dispersion processes as well as the precipitation processes.

On a larger—global—scale, there is current concern and scientific investigation of the possibility that humanity's increasing production of carbon dioxide through rapidly growing rates of combustion of fossil fuels, mainly coal, will begin to affect weather adversely in large portions of the world or even globally. The basis for the concern is that carbon dioxide absorbs heat from solar radiation, even though transparent to visible light, and if the average carbon dioxide content of the earth's atmosphere were to be raised substantially, it would be expected to cause a net increase in absorption and retention of incident solar radiation which would in turn raise the average temperature of the atmosphere. Such a change in atmospheric temperature, if only by a few degrees, could have a profound impact on man and the entire environment.

At present no conclusions are available—just questions, serious concerns, and a body of data beginning to be accumulated.

Summary

Acid precipitation is an extremely complex and serious problem in some parts of the world. Existing published research that has been interpolated between sites around the Ft. Union indicates that there is no significant evidence that acid precipitation in the Ft. Union area will be a problem. However, current unpublished research being conducted by the North Dakota State Department of Health may contradict the interpolated NADP material. Results from the North Dakota State Department of Health research is expected to be included in the August 1982 air quality report.

The computer modeling analysis that will evaluate the cumulative effects of emissions of major pollutants as a result of the proposed action or alternatives will be included in the August 1982 air quality report. This will include projected ground level concentrations of those pollutants as related to state and federal air quality standards and increments pertaining to prevention of significant deterioration of air quality. Effects on visibility will also be analyzed.

The deposition of trace elements from the development of energy resources in west central North Dakota and eastern Montana are not expected to cause adverse effects on ecosystems during the short term period (1-year) but no conclusions can be reached regarding longer term effects. Further studies would be needed to examine these long term effects.

It is expected that the total radioactivity released to the atmosphere from energy conversion projects would be lower than naturally occurring radioactivity, and that radioactive impacts of energy development in the Ft. Union area would be very low.

The indirect effects from air emissions on water quality as a result of implementation of the proposed action or alternative will likely be insignificant, however, the effects on less alkaline waters outside the Ft. Union area is unknown.

Large scale operation of coal mining and conversion plants has some potential for causing weather changes on a local, regional, or even global scale. Local or regional weather is likely to be influenced to some extent but no conclusions can be drawn concerning the global effects.

WATER

During mining all the surface runoff from the disturbed area must be impounded and not released until it meets specified quality standards. An exception to this is when storm runoff exceeds the design capacity of the reservoir. Water that collects in open mine pits is also often pumped into these surface water reservoirs. While these catchment basins are in place, total water yields would be decreased due to increased evaporation and infiltration at the reservoirs. There will be a significant disruption in the flow of the ephemeral streams in the immediate vicinity of the mine. This will last for the duration of mining and reclamation in the area and will only affect a few livestock water supplies. The disruption of ephemeral stream flow will not result in a measurable decrease in the quality or quantity of stream flow in the perennial streams.

Aquifers

In many parts of this area, the mineable lignite lies below the water table and is often tapped by wells for domestic and stock water supplies. The mining process will remove the lignite and dig up the bedded over-burden. While the mine pit is open, groundwater from the surrounding area will seep into the pit causing a drawdown of water levels. This impact will be limited to the mining tracts and an area within about one mile of the tracts. Following the removal of the lignite, the over-burden spoils will be returned to the pits. Water levels in the spoil and the undisturbed surrounding area will return to approximate premining conditions.

Mining may cause changes in the chemical quality of the local groundwater. Increases in sodium, sulfates, and total dissolved solids concentrations have been reported by Groenewold, Houghton, and Van Voast at

mines in the Fort Union formation of Montana and North Dakota. The magnitude of the increases was variable but dependent upon the overburden characteristics and reclamation practices. This impact will result in degradation of groundwater which is tapped by shallow wells within the tracts and in some areas will move through the groundwater system away from the tract. The extent of this movement will vary depending upon the local hydrology and over-burden. It is impossible to predict accurately how far away from a mined area degraded water will move, but dilution and a reversal of the geochemical reactions caused by mining will likely limit the extent of this impact to no more than a couple of miles distance from a mine. There is sufficient impermeable material below the mineable lignite to prevent the degradation of the lower aquifers.

Alternative 1

There are between 45 and 162 water wells that will experience water level drawdowns or will have the quality of their water source degraded as mining moves across the area (see Table 3-2). These wells are used for domestic and stockwater supplies.

If federal coal was not leased and mining occured on the private coal checkerboarded with the federal coal, the impacts described above would still occur.

Alternative 2

There are between 106 and 330 water wells that will experience water level drawdowns or will have the quality of their water source degraded as mining moves across the area. This is between 61 and 168 more waterwells than Alternative 1, Table 3-4. Most of these wells are used for domestic and stockwater supplies. Some of the shallow wells used by the city of Beach, North Dakota will also experience water level lowerings and degraded water quality. Water of similar quantity and quality is available in deeper aquifers which would be unaffected by mining, but associated with these deeper replacement wells would be higher operating and maintenance costs to the local water users. Also any additional wells needed in the future after the mining company has fulfilled its replacement obligations and left the area would cost the local water user more to drill.

Additional Water Needs

The water requirements for the mine can be met by using shallow wells. The source of water for the facilities will be the Yellowstone River and Lake Sakakawea, and Table 3-2 shows how much water will be required.

The Bureau of Reclamation (Water for Energy—Missouri River Reservoirs Final Environmental Impact Statement, 1977) has identified the annual availability

TABLE 3-2

Total Number of Water Wells Impacted and Water Requirements By Alternative

	Number of Water Wells Impacted	Local Water Requirements (gal/day)	Fort Peck Reservoir (acre feet/yr)	Yellowstone River (acre feet/yr)	Lake Sakakawea (acre feet/yr)
Alternative 1*	45-162	0	0	0	0
Alternative 2	106-330	149,600	0	22,000	24,500
Alternative 3	171-458	235,600	23,000	23,000	50,000
Alternative 4	180-527	266,600	23,000	10,000	62,500
Alternative 5	216-563	327,600	36,000	22,000	62,500
Alternative 6	347-734	443,600	74,000	32,000	62,500
Woodson PRLA and Alt. 3	196-483	248,600	23,000	36,000	50,500
Meridian Exchange Proposal and Alt. 3					
Initial Production Meridian	191-478	217,600	16,600	23,000	50,500
Full Production Meridian	191-478	235,600	23,000	23,000	50,500
Federal plus Full Meridian	233-520	280,600	34,500	23,000	50,500

*The number of wells would probably be similar if the no lease action occurs.

Source: Site Specific Analysis, BLM, 1982

of 300,000 acre-feet of water for energy development at Lake Sakakawea and also 300,000 acre-feet of water at Fort Peck Reservoir. This water is available beyond their projections of increased water use for all other purposes (e.g., irrigation, municipal, Indian claims, etc.) over the next 50 years. The state of Montana and the Bureau of Reclamation (Water Reservations and Current Water Availability in the Yellowstone River Basin, 1981) have identified the average annual availability of 2,147,900 acre-feet and minimum annual availability of 64,700 acre-feet of water from the Yellowstone River at Sidney, Montana. This water is available for all uses.

While this water is physically available in the Yellowstone—Missouri River system, distribution of the water among the various states in the Missouri River basin is a sensitive issue. Montana and North Dakota are both giving high priority to quantifying their present and future water needs in the face of downstream proposals to divert large quantities of Missouri River water.

There is sufficient available water in the Yellowstone River and Lake Sakakawea to meet the water requirements of this alternative.

Other Water Uses

There is a slight chance that mining along the northern edge of the Dunn Center tract may cause some degradation of subsurface or surface water along Spring Creek. This water is used for irrigation and also is covered by state quality standards for percent sodium and sulfate concentrations.

Industrial Wastes

Coal conversion facilities will produce five types of waste products including gasifier ash, boiler bottom ash, fly ash, gas purification sludge, and water. Electrical generation plants will discharge boiler bottom ash, fly ash, and water while a gasification or liquefaction plant could produce all five types of waste products.

At electrical generation plants most of the waste water comes from the cooling process, and this process will raise the water temperature. The ash is sometimes sluiced (moved by mixing with water) into a holding pond with the cooling water. This ash sludge typically has high concentrations of ~~total~~ dissolved solids, sodium, sulfates, and some trace elements (e.g., arsenic, selenium, molybdenum). The water that is discharged from these ponds is well diluted by the cooling water and the impact on larger bodies of water (e.g., Lake Sakakawea, Fort Peck Reservoir, Missouri River, Yellowstone River) will be negligible. If this water was discharged to smaller streams (Heart River, Spring Creek, and Redwater River) it would cause violations of the water quality standard for temperature. The sludge from the bottom of the holding pond and/or ash handled in dry form is then disposed of in the mine pit.

Bottom ash has been found to be very insoluble and is often used as road surface material. Groenewold (1980) has investigated the hydrologic consequences of the mine pit disposal method on the local hydrology at one site in North Dakota. He found that if fly ash was placed in a position below the post mining water table there was potential for high concentrations of sulfates, arsenic, selenium, molybdenum and lead in the groundwater. These concentrations were all in excess of drinking water standards. At the facilities that have SO_2 scrubbers for air quality purposes much of the fly ash may be used in this process. The waste from the scrubbers (flue-gas-desulfurization waste) was not found to produce as great a change in the chemical character of the local groundwater.

In the gasification and liquefaction processes water is incorporated into the final product. The only waste water will be from the cooling process for the electrical generation unit associated with the gasification unit. This cooling water may also be used in the gasification process and not discharged from the facility site. It is still unclear exactly what solid wastes a gasification plant will produce because of the newness of the proposed process. Boiler bottom ash and fly ash will be about the same quality as that at electric plants but will not be produced in as much quantity. In addition to these ashes, material will be produced which is classified as hazardous by the Environmental Protection Agency (EPA). Much of these materials will be organic in nature and an attempt will be made to market them. All of the organic substances which are not marketed could be incinerated. Other hazardous materials will result from additives used during the gasification process as chemical reaction manipulators. All hazardous materials must be disposed of at an EPA approved hazardous waste disposal site. This could be located at the plant site or the wastes could be transported to an approved disposal area already existing. Generally gasification wastes could include sludge with high sodium, sulfates, trace metals (some "hazardous"), and organics (some "hazardous").

Problems

Degradation of the water quality in the near surface aquifers will render these aquifers almost useless, and this condition will continue indefinitely. There may be areas where the water quality does not become poor enough to prohibit its future development for stockwater or even domestic purposes. However, any wells that are established prior to mining and are degraded by mining activity will have to be replaced by the mining company. This will apply to wells inside and outside of the tract or mine area.

There is no practical way to restore the alluvial valley floors or to improve the quality of groundwater before it enters Spring Creek. If groundwater from the mining area is going to degrade the flow in this stream, the only

way to prevent this is to establish a no mining buffer zone, but the exact size of the buffer zone is not determinable at the present time. The Dunn Center tract will not be significantly reduced in size even in a worst case situation.

There is enough water within the region to satisfy the requirements of both the industrial development and the domestic needs of the increase in population. The problem is the lack of treatment or distribution systems. The smaller towns can add additional water wells to existing water systems. Beach may have to consider switching from groundwater to surface water or a combination of ground and surface water. This need will only occur during the construction period. The city of Dickinson is outgrowing its surface water supply and will have to build an additional surface water storage on another local stream or else pipe water from Lake Sakakawea or Lake Tschida. Currently a study is underway to build such a pipeline from Lake Sakakawea to a large area of southwestern North Dakota including Dickinson. Since the coal conversion facilities will also require water pipelines from the major reservoirs it is possible that these could also be designed to carry municipal water. A problem with this solution is that the facility and pipeline could not be completed until after the construction work force was already living in the area creating the extra demand for water.

Disposal of facility wastes will have to be carefully planned. The potential for impacts to groundwater can be reduced by selectively placing wastes where they will be above the groundwater level, by transporting them off site to a dry location, or by constructing lined disposal pits.

Currently, all solid wastes are required by state regulation to be buried in lined pits. This disposal method isolates the pollutants from the hydrologic system. Over the life of an average facility the burial of wastes will require about a section (640 acres) of land area, and the future use of this land will be limited. No water well drilling or other activity which may puncture the water tight lining could be allowed. All water discharges must be permitted by state and federal agencies so that the quality standards for the receiving waters are not violated.

There are no known impacts which would affect the water resources of the Fort Berthold or Fort Peck Indian Reservations.

Alternative 3

The impacts associated with leasing Alternative 3 will generally be the same as those identified under Alternatives 1 and 2. The differences in total impacts will come simply as a result of a larger area being affected by the same general impacts. Table 3-2 shows that for this alternative between 171 and 458 water wells will be impacted and Lake Sakakawea, the Yellowstone River, and Fort Peck Reservoir will be used as facility water sources. This is between 65 and 128 more wells than Alternative 2, Table 3-2. These water sources have sufficient available water to meet the water requirements of this alternative (State of Montana DNR, 1981 and USDI Bureau of Reclamation, 1977, see Alternative 2).

Alternative 4

The impacts associated with leasing Alternative 4 will generally be the same as those identified under Alternatives 1 and 2. The differences in total impacts will come as a result of a larger area being affected by the same general impacts and the inclusion of the Zenith tract which has special concerns. Table 3-2 shows that for this alternative between 180 and 527 water wells will be impacted and Lake Sakakawea, the Yellowstone River and Fort Peck Reservoir will be used as facility water sources. This is between 8 and 69 more wells than Alternative 3. These water sources have sufficient available water to meet the water requirements of this alternative (State of Montana DNR, 1981 and USDI Bureau of Reclamation, 1977, see Alternative 2).

In the Zenith tract area, mining will cause degradation of subsurface and surface water along the Heart River. It is impossible to predict how much will occur, but any degradation will cause a violation of the water quality standards for the river. If upstream runoff is allowed to pass through the mine area unaltered, the quantity of streamflow will not be significantly changed. The quality of Patterson Lake will also be degraded. However, since the percentage of water in Patterson Lake that originates in the tract area is small, the amount of degradation will be less at the lake than upstream. In order to avoid degradation of water quality in the river, a buffer zone of no mining could be established, buy the exact size of this buffer zone is not determinable at the present time. It probably would reduce the size of this tract by a large amount.

Alternative 5

The impacts associated with leasing Alternative 5 will generally be the same as those identified under Alternatives 1 and 2. The differences in total impacts will come as a result of a larger area being affected by the same general impacts and the inclusion of the Zenith and Redwater II tract which have special concerns. Table 3-2 shows that for this alternative between 216 and 563 water wells will be impacted and Lake Sakakawea, the Yellowstone River, and Fort Peck Reservoir will be used as facility water sources. This is between 45 and 105 more wells than in Alternative 4. These water sources have sufficient available water to meet the water requirements of this alternative (State of Montana DNR,

1981 and USDI Bureau of Reclamation, 1977, see Alternative 2). The impacts peculiar to the Zenith tract are discussed in Alternative 4, and the impacts peculiar to the Redwater II tract area are discussed below.

Mining the Redwater II tract would completely destroy a portion of the Redwater River valley. This area is likely to be an alluvial valley floor, and in this case the valley and a buffer zone could not be mined. Mining through the river will also cause degradation to the quality and possibly quantity of water available to downstream irrigators. There are no specific water quality standards for the chemical constituents which may be increased, however, the standards state "degradation which will impact established beneficial uses will not be allowed." Establishing a no mining buffer zone to protect the water quality and quantity would remove a large part of this tract from mining.

Alternative 6

The impacts associated with leasing Alternative 6 will generally be the same as those identified under Alternatives 1 and 2. The differences in total impacts will come as a result of a larger area being affected by the same general impacts and the inclusion of the Zenith, Redwater I, and Redwater II tracts which have special concerns. Table 3-2 shows that for this alternative between 347 and 734 water wells will be impacted and Lake Sakakawea, the Yellowstone River, and Fort Peck Reservoir will be used as facility water sources. This is between 131 and 171 more wells than in Alternative 5. These water sources have sufficient available water to meet the water requirements of this alternative (State of Montana DNR, 1981 and USDI Bureau of Reclamation, 1977, see Alternative 2). The population increases for this alternative may force the town of Circle, Montana to consider switching from groundwater to surface water or to a combination of ground and surface water for its municipal water supply. The impacts peculiar to the Zenith, Redwater I, and Redwater II tract areas are discussed in Alternatives 4 and 5. Redwater I has the same impacts as Redwater II.

Woodson PRLA

The impacts associated with leasing the Woodson PRLA will generally be the same as those identified under Alternative 3. The differences in total impacts will come simply as a result of a larger area being affected by the same general impacts. Table 3-2 shows that for the Woodson PRLA approximately 25 water wells will be impacted and the Yellowstone River could be used as a facility water source. This would change the wells impacted to between 196 and 483. This water source has sufficient available water to meet the water requirements of the Woodson PRLA (State of Montana DNR, 1981 and USDI Bureau of Reclamation, 1977, see Alternative 2).

Meridian Exchange Proposal

The impacts associated with leasing under the proposed Meridian Exchange will generally be the same as those identified under Alternative 3. The differences in total impacts will come simply as a result of a larger area being affected by the same general impacts. Table 3-2 shows that for this proposal approximately 62 water wells (with both Meridian and BLM tracts) will be impacted and Fort Peck Reservoir will be used as a facility water source. This water source has sufficient available water to meet the water requirements of this proposal (State of Montana DNR, 1981 and USDI Bureau of Reclamation, 1977, see Alternative 2). The population increases for this proposal may force the town of Circle, Montana, to consider switching from groundwater to surface water or to a combination of ground and surface water for its municipal water supply.

Summary

Mining activity in all of the alternatives would have varying degrees of impact upon the groundwater resource. The chemical quality of the groundwater could be changed by mining both on the tracts as well as off the tracts. The magnitude will be variable. The number of wells that would experience water level drawdowns or have the quality degraded varies from 45 to 734. The necessity to drill deeper replacement wells to obtain the same quality water that the original wells had would mean higher operating and maintenance costs to the water users.

The availability of surface water for municipal and industrial use is physically available in Lake Sakakawea, Fort Peck Reservoir, and the Yellowstone River. However, distribution of this water among the various states in the Missouri River basin is a sensitive issue.

There is the potential for some localized problems with municipal water supplies such as Circle, Montana, may be forced to consider using surface water or a combination of groundwater and surface water to meet the needs of an increased population. Patterson Lake, water supply for Dickinson, North Dakota, would also experience some degradation of water quality.

Disposal of facility wastes will have to be carefully planned and water discharges must be permitted by state and federal agencies so the quality standards are not violated. There are no known impacts which would affect the water resources of the Fort Berthold or Fort Peck Indian Reservations.

AGRICULTURE

Alternative 1

All tracts under Alternative 1 constitute production maintenance of existing mines or federal coal which otherwise would be by-passed by existing mines. Soils and agricultural impacts are analyzed for the proposed additional acreages. Mining of adjacent acreages already is underway, to the extent of 8,202 acres (1980 figures).

Reclamation

The types of impacts affecting the soil resource have been discussed in the BLM planning documents (URA, MFP) for this area. The basic mining impacts are the disruption of the present soil bodies as they exist, with the ensuing temporary loss of productivity and problems with erosion, compaction, and instability.

Sufficient suitable plant growth material of good to fair quality is available within the upper 60 inches of topsoil to respread tract areas disturbed during mining activities to a depth of 37 to 47 inches depending upon the tract involved (Table 3-3).

National Prime Farmlands requiring the special SMCRA stipulations of separate removal, storage, and respreading of the A horizon, B horizon, and subsoil material would affect from 91 acres to 2,780 acres on specific tracts under consideration for leasing under this alternative.

Over the long run, the original level of productivity of the soil resource should return to the area. Where saline or sodic soil material can be replaced by better quality material, such as may be identified from within the overburden material, productivity should even improve.

Land Disturbance and Production Losses

The total annual disturbance during peak mining years within the tracts identified in this alternative is somewhat less (-5 percent) than acreage presently left bare annually due to summer fallow (14,055 acres) in the dryland farming cycle.

An average of 5,164 acres of cropland, excluding the acres of summer fallow, would be removed from production during each of the peak mining years resulting in an average maximum annual loss during peak mining operation of 136,000 bushels of wheat.

Peak mining disturbance of 1,508 acres of hayland would result in an annual loss of 2,326 tons of hay production.

An average of 9,955 acres of rangeland would also be removed from production during peak mining operations, resulting in an average maximum loss of 5,031 animal unit months (AUMs)(Table 3-4).

TABLE 3-3

Suitable Plant Growth Material (SPGM)
Alternative 1

	Good			Fair			Poor			Unsuitable			Total			
	Acre Feet	Depth In.	%	Acre Feet	Depth In.	%	Acre Feet	Depth In.	%	Acre Feet	Depth In.	%	Acre Feet	Depth In.	%	Tract Acres
Existing Total*	128340			263228			28773			121346			541685			108337
Existing Average*		14	23.59		28	46.07		3	5.10		15	25.24		60	100.00	
Alt. Totals	128340			263226			28773			121346			541685			108337
Alt. Averages		8	12.70		15	24.81		2	2.75		8	13.59		32	53.85	

*These figures represent continued operation of mines and facilities associated with the production maintenance/by-pass tracts. Acreage figures would be similar whether or not federal coal is leased. Only reserve ownership would change appreciably. The figures do not reflect information on the Gascoyne, Husky, Savage, and Velva mines.

TABLE 3-4

Vegetation Types
Alternative 1

	Cropland		Native Prairie		Wetlands		Woodlands		Other		Total	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
Alternative 1 Total*	53704	49.6	34421	31.8	4444	4.1	5417	5.0	10351	9.6	108337	100.0

*These figures represent continued operation of mines and facilities associated with the production maintenance/by-pass tracts. Acreage figures would be similar whether or not federal coal is leased. Only reserve ownership would change appreciably. The figures do not reflect information on the Gascoyne, Husky, Savage, and Velva mines.

These losses would not significantly reduce regional agricultural production; however, individual operators could be severely impacted.

Agricultural production on the tracts average from 22 to 39 percent of the combined total production of all 123 crop and livestock operators.

Disturbance of wetlands and woodlands is discussed in the Wildlife section.

Economic Influences on the Agricultural Community

On an average basis there would be 1,899 acres of land removed from production each year during the development period. During the peak mining years 17,404 acres of land would be removed from agriculture and the gross farm income value of agricultural production would be reduced by $383,900 (7.7 percent) annually. This value represents about one percent of the combined value of the affected counties' annual agricultural production.

During the peak mining years 17,404 acres would be out of production at any given time and the impact on individual farms/ranches would vary widely. Table 3-5 shows the number of farm/ranch operations by class and the extent to which each could be affected by coal mining during the peak mining years.

Overall, the average loss in net income for all operators per tract would be $8.65 to $15.67 per acre. This loss would occur annually, whereas coal is a one-time harvest. The present value of losing this income in perpetuity at 10 percent interest for all land disturbance in this alternative would be about $123,400 or 11.9 percent of total operator net income annually in peak years. Present average worth of net income losses per million tons of coal is $891.

Based on the analysis described in Chapter 2, it appears that a farm/ranch operator that leases 38 to 52 percent of the land affected by mining could be compensated many times more than he or she might lose in agricultural income. On the average, about 61 to 78 percent of the land operated by the total 123 farmers/ranchers lie outside the tracts. Depending on the level of compensation, as discussed in Chapter 2, and land ownership patterns many operators could be receiving compensation for impacts adjacent to the coal tract.

Impacts on directly affected farmers and ranchers would be mitigated to the extent they are compensated. The Department of Agriculture has programs available to help mitigate some impacts. These, of course, are available to all farmers and ranchers. The BLM has no programs within its jurisdiction to mitigate impacts to individual farmers and ranchers.

Conclusions

Short-term soil disturbance would somewhat exceed that acreage presently left bare annually due to summer fallow. Preliminary indications from completed and ongoing research are that, in the long term, agricultural productivity of mined land can be restored.

Because Alternative 1 addresses the leasing of federal coal that otherwise could be by-passed in ongoing mining operations, impacts analyzed do not constitute additional disturbance, merely alternative areas within which mining would proceed.

No soil or agricultural production impacts were noted for this alternative, as opposed to comparable adjacent mine area acreages as discussed in Chapter 2 without the proposed action.

TABLE 3-5
Impact on Farm/Ranch Operations of Reducing Land Acreage Due to Coal Mining
Alternative 1

	Present Situation			Percentage Reduction in Farm/Ranch Acreage							
				0 - 25		26 - 50		51 - 75		76 - 100	
	Acres in Farm	Gross Farm Income ($)	Net Farm Income ($)	Number Operations[1]	Reduced Net Farm Income[2]	Number Operations[1]	Reduced Net Farm Income[2]	Number Operations[1]	Reduced Net Farm Income[2]	Number Operations[1]	Reduced Net Farm Income[2]
Small Cash Crop	1320	33,000	8400	22	3000	16	5900	6	7700	26	11,500[3]
Large Cash Crop	3860	98,700	25,300	3	9200	1	19,000	2	28,600	0	36,400
Crop & Livestock	3860	82,200	19,600	20	7300	11	15,700	4	24,400	1	52,300
Small Livestock	7200	125,900	13,900	5	5700	3	13,200	3	23,000	0	32,400
Large Livestock	12,790	188,200	1,700	0	3800	0	9,200	0	15,600	0	31,600
Extra Large Livestock	29,000	326,000	30,100	0	1500	0	28,100	0	19,300	0	61,000

Source: Economic Research Service, U.S. Department of Agriculture.

[1]Number of farm/ranch operations whose acreage would be reduced from 0-25 percent, 26-50 percent, 51-75 percent, and 76-100 percent respectively.
[2]Reduction per farm from present net farm income with 25 percent, 50 percent, and 100 percent reduction in farm/ranch acreage.
[3]The reduction in net farm income with 100 percent acreage reduction is more than present net farm income because it is assumed that the operations would maintain machinery and equipment until the land can be farmed again.

Alternative 2

Many of the types of impacts affecting agriculture as discussed in Alternative 1 will be the same in Alternative 2 and will not be discussed again. Only additional impacts and the total impacts for Alternative 2 will be discussed.

Reclamation

Sufficient suitable plant growth material of good to fair quality is available within the upper 60 inches of topsoil to respread tract areas disturbed during mining activities to a depth of 33 to 53 inches depending upon the tract involved (see Table 3-6).

National Prime Farmlands vary from 151 acres to 1,742 acres on the additional tracts. In total, these stipulations would affect from 242 acres to 4522 acres for all the tracts in Alternative 2.

Land Disturbance and Production Losses

During peak years 17 to 50 percent of individual tract acreages would be displaced from agricultural use. The acreages for the various vegetative types for this alternative are shown in Table 3-7.

An average of 7,007 to 9,014 acres of cropland, excluding the acres of summer fallow, would be removed from production during each of the peak mining years for the new production tracts. This would result in an average maximum annual loss during peak mining operations of 198,406 to 258,413 bushels of wheat. For Alternative 2 an average of 12,171 to 14,178 acres of cropland would be removed from production resulting in an average maximum annual loss of 334,406 to 394,413 bushels of wheat. This cropland would be out of production ten to fifteen years.

Peak mining disturbance of 1,676 acres of hayland would result in an annual loss of 2,365 tons of hay production for the new production tracts. An annual loss of 4,691 tons of hay production would result from peak mining disturbance of 3,184 acres of hayland in Alternative 2.

An average of 5,018 to 5,756 acres of rangeland would also be removed from production during peak mining of new production tracts, and this would result in an average maximum loss of 2,246 to 2,416 AUMs. This alternative would lose an average maximum of 7,277 to 7,447 AUMs from the removal of 14,973 to 15,711 acres of rangeland. This rangeland would be out of production ten to fifteen years.

Agricultural production on the tracts average from 17 to 39 percent of the combined total production of all 273 crop and livestock operators.

Wetland and woodland disturbance is discussed in the Wildlife section.

TABLE 3-6
Suitable Plant Growth Material (SPGM)
Alternative 2

	Good			Fair			Poor			Unsuitable			Total			
	Acre Feet	Depth In.	%	Acre Feet	Depth In.	%	Acre Feet	Depth In.	%	Acre Feet	Depth In.	%	Acre Feet	Depth In.	%	Tract Acres
New Prod. Total	64134			162017			22959			72480			321590			64318
New Prod. Average		11	18.65		35	57.80		4	6.33		10	17.23		60	100.00	
Alt. Totals	192474			425243			51732			193826			863275			172655
Alt. Averages		13	21.53		31	50.96		3	5.61		13	21.00		60	100.00	

TABLE 3-7
Vegetation Types
Alternative 2

	Cropland		Native Prairie		Wetlands		Woodlands		Other		Total	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
New Prod. Total	44563	69.3	15542	24.2	2391	3.7	621	1.0	1201	1.9	64318	100.0
Grand Total	98267	56.0	49963	28.0	6835	4.0	6038	3.5	11552	6.7	172655	100.0

Approximately 3,480 total acres for the facility sites associated with the new production tracts would be taken out of agricultural production. In a worst case analysis 48,432 bushels of wheat would be lost annually for the life of the energy conversion facilities.

A short-term disruption of 12 acres per mile would result during construction of an undetermined total length of water pipelines. Roadways would disturb 14.5 acres per mile. Where railroad spurs would be developed, agriculture would be eliminated on 18 acres per mile for the entire life of the facilities.

Due to nitrogen oxides, sulfur dioxide, and particulate matter, potential negative impacts to vegetation and to livestock exist downwind from each of the two gasification facilities, one indirect liquefaction plant, and one electric power coal conversion facility analyzed under this alternative.

These negative impacts would be analyzed in detail by the state permitting authorities during their review of facility permit applications.

Economic Influences on the Agricultural Community

On an average basis there would be 1,316 acres of land removed from production each year during the development period for the new production tracts. This amounts to 3,215 acres for the alternative. During the peak mining years of the new production tracts 12,520 acres of land would be removed from production and the gross farm income value would be reduced by $688,500 (8.4 percent) annually. This value represents about one percent of the combined value of the affected counties' annual agricultural production. The removal from agriculture of 29,924 acres of land during Alternative 2 peak mining years would reduce the gross farm income value of agricultural production by $1,072,400 (8.1 percent) annually.

During the peak mining years, 12,520 acres for new production tracts and 29,924 for the alternative would be out of production at any given time and the impact on individual farms/ranches would vary widely. Table 3-8 shows the number of farm/ranch operations by class and the extent to which each could be affected by coal mining during the peak mining years.

Overall, the average annual peak year loss in net income for all operators per tract would be $11.08 to $15.63 per acre for new production tracts and $8.65 to $15.67 per acre for Alternative 2. The present value of losing this income in perpetuity at 10 percent interest for all land disturbance in this alternative would be about $243,300 or 12.0 percent of total operator net income annually in peak years. Present average worth of new income losses per million tons of coal is $1,849.

Compensation to the farm/ranch operator would be similar to that described in Chapter 2 and for Alternative 1. Under these terms, compensation could average from $160 to $870 per acre within the tracts delineated in this alternative.

Operators that have only lease land within the tracts would not be compensated for the lost leases. Loss in profit realized, however, would be less than the overall tract averages of $8.65 to $15.67 per acre annually.

Those farmers and ranchers whose land is not directly taken out of production but are located in the general area could also be affected by coal mining, but the effects on these operators are much more difficult to

TABLE 3-8

Impact on Farm/Ranch Operations of Reducing Land Acreage Due to Coal Mining Alternative 2

	Present Situation			Percentage Reduction in Farm/Ranch Acreage							
				0 - 25		26 - 50		51 - 75		76 - 100	
	Acres in Farm	Gross Farm Income ($)	Net Farm Income ($)	Number Operations[1]	Reduced Net Farm Income[2]	Number Operations[1]	Reduced Net Farm Income[2]	Number Operations[1]	Reduced Net Farm Income[2]	Number Operations[1]	Reduced Net Farm Income[2]
Small Cash Crop	1320	33,000	8400	36	3000	13	5900	11	7700	28	11,500[3]
Large Cash Crop	3860	98,700	25,300	16	9200	8	19,000	3	28,600	1	36,400
Crop & Livestock	3860	82,200	19,600	17	7300	7	15,700	4	24,400	4	52,300
Small Livestock	7200	125,900	13,900	2	5700	0	13,200	0	23,000	0	32,400
Large Livestock	12,790	188,200	1,700	0	3800	0	9,200	0	15,600	0	31,600
Extra Large Livestock	29,000	326,000	30,100	0	1500	0	28,100	0	19,300	0	61,000

Source: Economic Research Service, U.S. Department of Agriculture.

[1]Number of farm/ranch operations whose acreage would be reduced from 0-25 percent, 26-50 percent, 51-75 percent, and 76-100 percent respectively.

[2]Reduction per farm from present net farm income with 25 percent, 50 percent, and 100 percent reduction in farm/ranch acreage.

[3]The reduction in net farm income with 100 percent acreage reduction is more than present net farm income because it is assumed that the operations would maintain machinery and equipment until the land can be farmed again.

trace. The hydrology section mentions that known wells outside the tract boundaries could experience water level lowering. It also mentions the potential for water quality degradation. Reduction in water quality and the level of wells would affect the operations of farms/ranches and their costs for if a livestock well went dry and could not be replaced, this could cause the livestock to trail further. There are too many unknowns at this point in time to evaluate in every detail how this "off-site" impact might affect farm/ranch operations and cost. Impacts to water quality or quanity could be mitigated through the law. If a farmer or rancher could prove that coal mining is affecting his or her water resource, there is a potential for recovering damages based on the illegal taking of a property right. (Field Solicitor—U.S. Department of Interior.)

Coal mine development can also cause "people" problems for area farmers and ranchers. Of major concern is the effect on lifestyle and the general nuisance caused by increased population. This includes such activities as theft, trespassing, gates left open, vandalism, and increased traffic on narrow rural roads.

Coal development would compete directly with agriculture for labor resources as both industries place a premium on workers in their physical prime who are accustomed to working with machinery and to working long hours outdoors.

Operators of small farms may take advantage of the new off-farm job opportunities that the coal industry could provide. This allows for a shift for themselves and their families into higher levels of income while operating their farms on a part-time basis. In 1978, a total of 453 farm operators in Dawson and Wibaux Counties, Montana and Golden Valley, Dunn, and McLean Counties, in North Dakota reported working 200 days or more off the farm. This is 11 to 18 percent of the total farm operators in the counties. Also, as agricultural land is taken out of production there would be a small decrease in the need for farm labor. This would amount to about 12 to 42 man-months annually per tract during peak mining years.

Conclusions

Short-term soil disturbance would somewhat exceed that acreage presently left bare annually due to summer fallow. Preliminary indications from completed and ongoing research are that, in the long term, agricultural productivity of mined land can be restored.

Tract acreage dependency averages from 17 to 39 percent of the combined total production of all 273 crop and livestock operators.

Individual operators may be severely impacted; however, compensation from rental, bonus, royalty, and damage payments on the average would considerably exceed losses in agricultural income. Operators that have only lease land within the tracts would not be compensated for the lost leases.

On a regional basis, crop production losses during peak mining years amount to less than one percent of total production for those counties encompassing Alternative 2 tracts.

The 273 farm and ranch operations with lands affected in whole or in part by mining of tract acreage constitute 7.9 percent of the counties' total.

These losses would not significantly reduce regional agricultural production, nor would the agriculture support economy be affected. Within the overall structure of an agricultural economy subjected to fluctuations in supply and demand, interest rates, and weather cycles, the regional impacts associated with energy development within the Fort Union tracts are miniscule.

Alternative 3

Reclamation

Sufficient suitable plant growth material of good to fair quality is available within the upper 60 inches of topsoil to respread tract areas disturbed during mining activities to a depth of 33 to 53 inches depending upon the tract involved (see Table 3-9).

National Prime Farmlands vary from 151 acres to 5,636 acres on the new production tracts under consideration for leasing under this alternative. These requirements would affect from 242 acres to 8416 acres on all tracts under consideration in this alternative.

Land Disturbance and Production Losses

During peak years 17 to 42 percent of individual tract acreages would be displaced from agricultural use. The acreages for the various vegetative types for this alternative are shown in Table 3-10 .

The total annual disturbance during peak mining years within the tracts identified in this alternative is somewhat more than double (+131 percent) that acreage presently left bare annually due to summer fallow (16,958 new production tracts) in the dryland farming cycle.

An average of 9,294 to 11,075 acres of cropland, excluding the acres of summer fallow, would be removed from production during each of the peak mining years of the new production tracts, and this would result in an average maximum annual loss during peak mining operation of 254,552 to 306,341 bushels of wheat. This disturbance is 28 percent greater than for Alternative 2. An average maximum annual loss of 390,552 to 442,341 bushels of wheat would occur for this alternative as a result of 14,458 to 16,239 acres of cropland being removed from production.

TABLE 3-9
Suitable Plant Growth Material (SPGM)
Alternative 3

	Good			Fair			Poor			Unsuitable			Total			
	Acre Feet	Depth In.	%	Acre Feet	Depth In.	%	Acre Feet	Depth In.	%	Acre Feet	Depth In.	%	Acre Feet	Depth In.	%	Tract Acres
New Prod. Total	100606			313558			99430			126847			649440			129888
New Prod. Average		10	16.93		32	52.87		8	13.62		10	16.57		60	100.00	
Alt. Totals	237946			576784			128203			248193			1191125			238225
Alt. Averages		12	19.84		30	49.90		6	9.89		12	20.37		60	100.00	

TABLE 3-10
Vegetation Types
Alternative 3

	Cropland		Native Prairie		Wetlands		Woodlands		Other		Total	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
New Prod. Total	64413	49.6	57007	43.9	4401	3.4	1285	1.0	2782	2.1	129888	100.0
Grand Total	118117	49.6	91428	38.4	8845	3.7	6702	2.8	13133	5.5	238225	100.0

Peak mining disturbance of 2,923 acres of hayland would result in an annual loss of 3,928 tons of hay production for the new production tracts. The result of mining disturbance of 4,431 acres in Alternative 3 is the annual loss of 6,254 tons of hay production.

An average of 16,876 to 22,229 acres of rangeland would also be removed from production during peak mining operations of new production tracts, resulting in an average maximum loss of 6,033 to 7,351 AUMs. This disturbance is more than double that estimated for Alternative 2. This alternative would have an average maximum loss of 11,064 to 12,382 AUMs resulting from removal of 26,831 acres of rangeland from production.

Agricultural production on the tracts average from 17 to 39 percent of the combined total production of all 362 crop and livestock operators.

Approximately 6,240 total acres for the facility sites associated with the new production tracts would be taken out of agricultural production. In a worst case analysis 86,484 bushels of wheat would be lost annually for the life of the energy conversion facilities.

Economic Influences on the Agricultural Community

On an average basis there would be 3,313 acres of land removed from production each year during the development period for the new production tracts. For the alternative, 5,212 acres would be removed from production. During the peak mining years of the new production tracts, 28,630 acres of land would be removed from production, and the gross farm income value would be reduced by $1,107,300 (8.2 percent) annually. This value represents about one percent of the combined value of the affected counties' annual agricultural production. The removal from production of 46,034 acres of land during peak mining years for Alternative 3 would reduce the gross farm income value by $1,491,200 (8.1 percent) annually.

During the peak mining years, 28,630 acres for new production tracts and 46,034 acres for the alternative would be out of production at any given time and the impact on individual farms/ranches would vary widely. Table 3-11 shows the number of farm/ranch operations by class and the extent to which each could be affected by coal mining during the peak mining years.

Overall, the average annual peak year loss in net income for all operators per tract would be $1.87 to $16.92 per acre for new production and total alternative tracts. The present value of losing this income in perpetuity at 10 percent interest for all land disturbance in this alternative would be about $366,300 or 11.8 percent of total operator net income annually in peak years. Present average worth of new income losses per million tons of coal is $1,510.

Compensation to the farm/ranch operator would be similar to that described in Chapter 2 and for affected operations in Alternative 1.

TABLE 3-11
Impact on Farm/Ranch Operations of Reducing Land Acreage Due to Coal Mining
Alternative 3

	Present Situation			Percentage Reduction in Farm/Ranch Acreage							
				0 - 25		26 - 50		51 - 75		76 - 100	
	Acres in Farm	Gross Farm Income ($)	Net Farm Income ($)	Number Operations[1]	Reduced Net Farm Income[2]	Number Operations[1]	Reduced Net Farm Income[2]	Number Operations[1]	Reduced Net Farm Income[2]	Number Operations[1]	Reduced Net Farm Income[2]
Small Cash Crop	1320	33,000	8400	53	3000	28	5900	21	7700	43	11,500[3]
Large Cash Crop	3860	98,700	25,300	18	9200	7	19,000	2	28,600	1	36,400
Crop & Livestock	3860	82,200	19,600	31	7300	12	15,700	8	24,400	5	52,300
Small Livestock	7200	125,900	13,900	6	5700	0	13,200	1	23,000	0	32,400
Large Livestock	12,790	188,200	1,700	1	3800	0	9,200	0	15,600	0	31,600
Extra Large Livestock	29,000	326,000	30,100	1	1500	1	28,100	0	19,300	0	61,000

Source: Economic Research Service, U.S. Department of Agriculture.

[1]Number of farm/ranch operations whose acreage would be reduced from 0-25 percent, 26-50 percent, 51-75 percent, and 76-100 percent respectively.
[2]Reduction per farm from present net farm income with 25 percent, 50 percent, and 100 percent reduction in farm/ranch acreage.
[3]The reduction in net farm income with 100 percent acreage reduction is more than present net farm income because it is assumed that the operations would maintain machinery and equipment until the land can be farmed again.

Operators of small farms at the same time may take advantage of the new off-farm job opportunities that the coal industry could provide. This provides a shift for themselves and their families into higher levels of income while operating their farms on a part-time basis. In 1978, a total of 521 farm operators in the affected counties reported working 200 days or more off the farm. This is 11 to 18 percent of the total farm operators in the counties. Also, as agricultural land is taken out of production there would be a small decrease in the need for farm labor. This would amount to about 8 to 42 man-months annually per tract during peak mining years.

Conclusions

Short-term soils disturbance would somewhat exceed that acreage presently left bare annually due to summer fallow. Preliminary indications from completed and ongoing research are that, in the long term, agricultural productivity of mined land can be restored.

Tract acreage dependency averages from 17 to 39 percent of the combined total production of all 362 crop and livestock operations.

Individual operators may be severely impacted; however, compensation from rental, bonus, royalty, and damage payments on the average would considerably exceed losses in agricultural income. Operators that have only leased land within the tracts would not be compensated for the lost leases.

On a regional basis, crop production losses during peak mining years amount to less than one percent of total production for those counties encompassing Alternative 3 tracts.

The 362 farm and ranch operations with lands affected in whole or in part by mining of tract acreage constitute 9.3 percent of the counties' total.

These losses would not significantly reduce regional agricultural production, nor would the agriculture support economy be affected. Within the overall structure of an agricultural economy subjected to fluctuations in supply and demand, interest rates, and weather cycles, the regional impacts associated with energy development within the Fort Union tracts are miniscule.

Alternative 4

Reclamation

Sufficient suitable plant growth material of good to fair quality is available within the upper 60 inches of topsoil to respread tract areas disturbed during mining activities to a depth of 20 to 57 inches depending upon the tract involved. An exception is the Zenith tract with only 16 inches of good to fair quality material within the top 60 inches (see Table 3-12). The availability of additional suitable plant growth material from within the overburden has not been definitively assessed at this time.

Land Disturbance and Production Losses

Table 3-13 presents the alternative's acreages of the various vegetation types. An average of 10,675 to 12,072 acres of cropland, excluding the acres of summer fallow, would be removed from production during each of the peak mining years of the new production tracts, resulting in an average maximum annual loss during peak mining operation of 287,194

TABLE 3-12
Suitable Plant Growth Material (SPGM)
Alternative 4

	Good			Fair			Poor			Unsuitable			Total			
	Acre Feet	Depth In.	%	Acre Feet	Depth In.	%	Acre Feet	Depth In.	%	Acre Feet	Depth In.	%	Acre Feet	Depth In.	%	Tract Acres
New Prod. Total	116341			296960			134934			152111			700345			140069
New Prod. Average		10	17.00		28	46.38		10	17.10		12	19.43		60	100.00	
Alt. Totals	244681			560186			163707			273457			1242030			248486
Alt. Averages		12	19.93		28	46.25		7	11.85		13	21.97		60	100.00	

TABLE 3-13
Vegetation Types
Alternative 4

	Cropland		Native Prairie		Wetlands		Woodlands		Other		Total	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
New Prod. Total	71483	51.0	58471	41.7	4936	3.5	2163	1.5	3016	2.2	140069	100.0
Grand Total	125187	50.4	92892	37.4	9380	3.8	7580	3.1	13367	5.4	248406	100.0

to 328,088 bushels of wheat. This disturbance is 13 percent greater than for Alternative 3. In this alternative an average maximum annual loss of 423,194 to 464,088 bushels of wheat would result from 15,839 to 17,236 acres of cropland being removed from production.

Peak mining disturbance of 3,435 acres of hayland would result in an annual loss of 4,583 tons of production for the new production tracts. The result of mining disturbance of 4,943 acres under Alternative 4 is the annual loss of 6,909 tons of hay production.

An average of 17,917 to 22,934 acres of rangeland would also be removed from production during peak mining operations of new production tracts, resulting in an average maximum loss of 6,750 to 8,003 AUMs. This disturbance is 12 percent greater than for Alternative 3. This alternative would have an average maximum loss of 11,781 to 13,034 AUMs resulting from removal of 27,872 to 32,889 acres of rangeland from production.

Agricultural production on the tracts average from 17 to 43 percent of the combined total production of all 382 crop and livestock operators.

Approximately 6,600 total acres for the facility sites associated with new production tracts would be taken out of agricultural production. In a worst case analysis 90,464 bushels of wheat would be lost annually for the life of the energy conversion facilities.

Economic Influences on the Agricultural Community

On an average basis there would be 3,671 acres of land removed from production each year during the development period for new production tracts. For the total alternative, 5,570 acres would be removed from production. During the peak mining years of the new production tracts, 30,920 acres of land would be removed from agriculture, and the gross farm income value of agricultural production would be reduced by $1,259,000 (10.1 percent) annually. This value represents about one percent of the combined value of the affected counties' annual agricultural production. The removal from production of 48,324 acres of land during peak mining years for Alternative 4 would reduce the gross farm income value by $1,642,900 (9.4 percent) annually.

During the peak mining years, 30,920 acres for new production tracts and 48,324 acres for the total alternative would be out of production at any given time and the impact on individual farms/ranches would vary widely. Table 3-14 shows the number of farm/ranch operations by class and the extent to which each could be affected by coal mining during the peak mining years.

Overall, the average annual peak year loss in net income for all operators per tract would be $1.87 to $16.92 per acre for both new production and total alternative tracts. The present value of losing this income in perpetuity at 10 percent interest for all land disturbance in this alternative would be about $417,400 or 12.4 percent of total operator net income annually in peak years. Present average worth of net income losses per million tons of coal is $1,466.

TABLE 3-14
Impact on Farm/Ranch Operations of Reducing Land Acreage Due to Coal Mining
Alternative 4

	Present Situation			Percentage Reduction in Farm/Ranch Acreage							
				0 - 25		26 - 50		51 - 75		76 - 100	
	Acres in Farm	Gross Farm Income ($)	Net Farm Income ($)	Number Operations[1]	Reduced Net Farm Income[2]	Number Operations[1]	Reduced Net Farm Income[2]	Number Operations[1]	Reduced Net Farm Income[2]	Number Operations[1]	Reduced Net Farm Income[2]
Small Cash Crop	1320	33,000	8400	54	3000	31	5900	25	7700	52	11,500[3]
Large Cash Crop	3860	98,700	25,300	17	9200	7	19,000	3	28,600	2	36,400
Crop & Livestock	3860	82,200	19,600	33	7300	13	15,700	8	24,400	4	52,300
Small Livestock	7200	125,900	13,900	6	5700	0	13,200	1	23,000	0	32,400
Large Livestock	12,790	188,200	1,700	1	3800	0	9,200	0	15,600	0	31,600
Extra Large Livestock	29,000	326,000	30,100	1	1500	1	28,100	0	19,300	0	61,000

Source: Economic Research Service, U.S. Department of Agriculture.

[1]Number of farm/ranch operations whose acreage would be reduced from 0-25 percent, 26-50 percent, 51-75 percent, and 76-100 percent respectively.
[2]Reduction per farm from present net farm income with 25 percent, 50 percent, and 100 percent reduction in farm/ranch acreage.
[3]The reduction in net farm income with 100 percent acreage reduction is more than present net farm income because it is assumed that the operations would maintain machinery and equipment until the land can be farmed again.

Compensation to the farm/ranch operator would be similar to that described in Chapter 2 and for affected operations in Alternative 1.

Operators of small farms may take advantage of the new off-farm job opportunities that the coal industry could provide. This provides a shift for themselves and their families into higher levels of income while operating their farms on a part-time basis. In 1978, a total of 645 farm operators in the affected counties reported working 200 days or more off the farm. This is 11-18 percent of the total farm operators in the counties. Also, as agricultural land is taken out of production there would be a small decrease in the need for farm labor. This would amount to about 13 to 42 man-months annually per tract during peak mining years.

Conclusions

Short-term soil disturbance would somewhat exceed that acreage presently left bare annually due to summer fallow. Preliminary indications from completed and ongoing research are that, in the long term, agricultural productivity of mined land can be restored.

Tract acreage dependency averages from 17 to 43 percent of the combined total production of all 382 crop and livestock operations.

Individual operators may be severely impacted; however, compensation from rental, bonus, royalty, and damage payments on the average would considerably exceed loses in agricultural income. Operators that have only leased land within the tracts would not be compensated for the lost leases.

On a regional basis, crop production losses during peak mining years amount to less than one percent of total production for those counties encompassing Alternative 4 tracts.

The 382 farm and ranch operations with lands affected in whole or in part by mining of tract acreage constitute 8.1 percent of the counties' total.

These losses would not significantly reduce regional agricultural production, nor would the agriculture support economy be affected. Within the overall structure of an agricultural economy subjected to fluctuations in supply and demand, interest rates, and weather cycles, the regional impacts associated with energy development within the Fort Union tracts are miniscule.

Alternative 5

Reclamation

Many of the impacts affecting agriculture have been discussed in previous alternatives. These impacts would be expected to occur in this alternative (see Table 3-15).

Land Disturbance and Production Losses

Table 3-16 presents the acreage for the various vegetation types in this alternative. An average of 13,272 to 16,012 acres of cropland, excluding the acres of summer fallow, would be removed from production during each of the peak mining years of the new production tracts and this would result in an average maximum annual loss during peak mining operation of 360,949 to 441,773 bushels of wheat. This disturbance is 26 percent greater than for Alternative 4. In this alternative, an average maxumun annual loss of 496,949 to 577,773 bushels of wheat would result from

TABLE 3-15
Suitable Plant Growth Material (SPGM)
Alternative 5

	Good			Fair			Poor			Unsuitable			Total			
	Acre Feet	Depth In.	%	Acre Feet	Depth In.	%	Acre Feet	Depth In.	%	Acre Feet	Depth In.	%	Acre Feet	Depth In.	%	Tract Acres
New Prod. Total	137529			381392			175387			171728			866035			173207
New Prod. Average		10	16.27		29	47.96		11	17.86		11	17.91		60	100.00	
Alt. Totals	265869			644618			204160			293074			1407720			281544
Alt. Averages		11	19.11		28	47.23		8	12.90		12	20.76		60	100.00	

TABLE 3-16
Vegetation Types
Alternative 5

	Cropland		Native Prairie		Wetlands		Woodlands		Other		Total	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
New Prod. Total	88210	50.9	74602	43.1	4976	2.9	2209	1.3	3210	1.9	173207	100.0
Grand Total	141914	50.4	109023	38.7	9420	3.3	7626	2.7	13561	4.8	281544	100.0

18,436 to 21,176 acres of cropland being removed from production.

Peak mining disturbance of 3,961 acres of hayland would result in an annual loss of 5,109 tons of hay production for the new production tracts. The result of mining disturbance of 5,469 acres in Alternative 5 is the annual loss of 7,435 tons of hay production.

An average of 22,287 to 29,570 acres of rangeland would also be removed from production during peak mining operations of the new production tracts, resulting in an average maximun loss of 7,857 to 9,684 AUMs. This disturbance is 16 percent greater than for Alternative 4. This alternative would have an average maximum loss of 12,888 to 14,715 AUMs resulting from the removal of 32,242 to 39,525 acres of rangeland from production.

Agricultural production on the tracts average from 17 to 43 percent of the combined total production of all 416 crop and livestock operators.

Approximately 8,160 total acres for the facility sites associated with new production tracts would be taken out of agricultural production. In a worst case analysis 112,616 bushels of wheat would be lost annually for the life of the energy conversion facility.

Economic Influences on the Agricultural Community

On an average basis, there would be 4,563 acres of land removed from production each year during the development period for new production tracts. For the total alternative, 6,462 acres would be removed from production. During the peak mining years of the new production tracts, 39,840 acres of land would be removed from agriculture, and the gross farm income value of agricultural production would be reduced by $1,560,900 (9.2 percent) annually. This value represents about one percent of the combined value of the affected counties' annual agricultural production. The removal from production of 57,244 acres of land during peak mining years for Alternative 5 would reduce the gross farm income value by $1,944,800 (8.8 percent) annually.

During the peak mining years 39,840 acres for new production tracts and 57,244 acres for the full alternative would be out of production at any given time, and the impact on individual farms/ranches would vary widely. Table 3-17 shows the number of farm/ranch operations by class and the extent to which each could be affected by coal mining during the peak mining years.

Overall, the average annual peak year loss in new income for all operators per tract would average $1.87 to $16.92 per acre for both new production and total alternative tracts. The present value of losing this income in perpetuity at 10 percent interest for all land disturbance in this alternative would be about $525,400 or 13.2 percent of total operator net income annually in peak years. Present average worth of net income losses per million tons of coal is $1,466.

TABLE 3-17
Impact on Farm/Ranch Operations of Reducing Land Acreage Due to Coal Mining
Alternative 5

	Present Situation			Percentage Reduction in Farm/Ranch Acreage							
				0 - 25		26 - 50		51 - 75		76 - 100	
	Acres in Farm	Gross Farm Income ($)	Net Farm Income ($)	Number Operations[1]	Reduced Net Farm Income[2]	Number Operations[1]	Reduced Net Farm Income[2]	Number Operations[1]	Reduced Net Farm Income[2]	Number Operations[1]	Reduced Net Farm Income[2]
Small Cash Crop	1320	33,000	8,400	60	3000	32	5,900	25	7,700	57	11,500[3]
Large Cash Crop	3860	98,700	25,300	28	9200	9	19,000	4	28,600	2	36,400
Crop & Livestock	3860	82,200	19,600	34	7300	15	15,700	9	24,400	6	52,300
Small Livestock	7200	125,900	13,900	7	5700	0	13,200	2	23,000	0	32,400
Large Livestock	12,790	188,200	1,700	1	3800	0	9,200	0	15,600	0	31,600
Extra Large Livestock	29,000	326,000	30,100	1	1500	1	28,100	0	19,300	0	61,000

Source: Economic Research Service, U.S. Department of Agriculture.

[1]Number of farm/ranch operations whose acreage would be reduced from 0-25 percent, 26-50 percent, 51-75 percent, and 76-100 percent respectively.
[2]Reduction per farm from present net farm income with 25 percent, 50 percent, and 100 percent reduction in farm/ranch acreage.
[3]The reduction in net farm income with 100 percent acreage reduction is more than present net farm income because it is assumed that the operations would maintain machinery and equipment until the land can be farmed again.

Conclusions

Short-term soil disturbance would somewhat exceed that acreage presently left bare annually due to summer fallow. Preliminary indications from completed and ongoing research are that, in the long term, agricultural productivity of mined land can be restored.

Tract acreage dependency averages from 17 to 43 percent of the combined total production of all 416 crop and livestock operators.

Individual operators may be severely impacted; however, compensation from rental, bonus, royalty, and damage payments on the average would considerably exceed losses in agricultural income. Operators that have only leased land within the tracts would not be compensated for the lost leases.

On a regional basis, crop production losses during peak mining years amount to one percent of total production for those counties encompassing Alternative 5 tracts.

The 416 farm and ranch operations with lands affected in whole or in part by mining of tract acreage constitute 8.8 percent of the counties' total.

These losses would not significantly reduce regional agricultural production, nor would the agriculture support economy be affected. Within the overall structure of an agricultural economy subjected to fluctuations in supply and demand, interest rates, and weather cycles, the regional impacts associated with energy development within the Fort Union tracts are miniscule.

Alternative 6

Reclamation

Many of the impacts affecting agriculture have been discussed in previous alternatives. These impacts would be expected to occur in this alternative (see Table 3-18).

Land Disturbance and Production Losses

Table 3-19 presents the acreage for the various vegetation types for this alternative.

An average of 19,599 to 25,590 acres of cropland, excluding the acres of summer fallow, would be removed from production during each of the peak mining years of the new production tracts resulting in an average maximum annual loss during peak mining operation of 544,050 to 718,977 bushels of wheat. This disturbance is 51 percent greater than for Alternative 5. In this alternative an average maximum annual loss of 680,050 to 854,977 bushels of wheat would result from 24,763 to 30,754 acres of cropland being removed from production.

Peak mining disturbance of 5,694 acres of hayland would result in an annual loss of 6,842 tons of hay production for the new production tracts. The result of mining disturbance of 7,202 acres in Alternative 6 is the annual loss of 9,168 tons of hay production.

An average of 30,588 to 41,886 acres of rangeland would also be removed from production during peak mining operations of the new production tracts resulting in an average maximum loss of 9,887 to 12,685

TABLE 3-18
Suitable Plant Growth Material (SPGM)
Alternative 6

	Good			Fair			Poor			Unsuitable			Total			
	Acre Feet	Depth In.	%	Acre Feet	Depth In.	%	Acre Feet	Depth In.	%	Acre Feet	Depth In.	%	Acre Feet	Depth In.	%	Tract Acres
New Prod. Total	179976			529600			245197			229008			1183780			236756
New Prod. Average		9	15.14		28	46.20		12	19.98		11	18.68		60	100.00	
Alt. Totals	308316			792826			273970			350354			1725465			345093
Alt. Averages		11	17.83		28	46.16		9	15.24		12	20.77		60	100.00	

TABLE 3-19
Vegetation Types
Alternative 6

	Cropland		Native Prairie		Wetlands		Woodlands		Other		Total	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
New Prod. Total	122417	51.7	102094	43.1	6033	2.5	2261	1.0	3951	1.7	236756	100.0
Grant Total	176121	51.0	136515	39.6	10477	3.0	7678	2.2	14302	4.1	345093	100.0

AUMs. This disturbance is 25 percent greater than for Alternative 5. This alternative would have an average maximum loss of 14,918 to 17,716 AUMs resulting from removal of 40,543 to 51,841 acres of rangeland from production.

Agricultural production on the tracts average from 17 to 43 percent of the combined total production of all 489 crop and livestock operators.

Approximately 11,280 total acres for the facility sites associated with new production tracts would be taken out of agricultural production. In a worst case analysis 157,188 bushels of wheat would be lost annually for the life of the energy conversion facilities.

Economic Influences on the Agricultural Community

On an average basis, there would be 6,414 acres of land removed from production each year during the development period for new production tracts. For the total alternative, 8,313 acres would be removed from production. During the peak mining years, 58,350 acres of land would be removed from production and the gross farm income value would be reduced by $2,148,800 (9.3 percent) annually. This value represents about one percent of the combined value of the affected counties' annual agricultural production. The removal from agriculture of 75,754 acres of land during peak mining years for Alternative 5 would reduce the gross farm income value by $2,532,700 (9.0 percent) annually.

During the peak mining years 58,350 acres for new production tracts and 75,754 acres for the full alternative would be out of production at any given time, and the impact on individual farms/ranches would vary widely. Table 3-20 shows the number of farm/ranch operations by class and the extent to which each could be affected by coal mining during the peak mining years.

Overall, the average annual peak year loss in net for all operators per tract would average $2.68 to $16.92 per acre for both new production and total alternative tracts. The present value of losing this income in perpetuity at 10 percent interest for all land disturbance in this alternative would be about $735,600, or 14.4 percent of total operator net income annually in peak years. Present average worth of net income losses per million tons of coal is $1,373.

Compensation to the farm/ranch operator would be similar to that described in Chapter 2 and for affected operations in Alternative 2.

Conclusions

Short-term soil disturbance would somewhat exceed that acreage presently left bare annually due to summer fallow. Preliminary indications from completed and ongoing research are that, in the long term, agricultural productivity of mined land can be restored.

Tract acreage dependency averages from 17 to 43 percent of the combined total production of all 489 crop and livestock operators.

Individual operators may be severely impacted; however, compensation from rental, bonus, royalty, and

TABLE 3-20
Impact on Farm/Ranch Operations of Reducing Land Acreage Due to Coal Mining
Alternative 6

	Present Situation			Percentage Reduction in Farm/Ranch Acreage							
				0 - 25		26 - 50		51 - 75		76 - 100	
	Acres in Farm	Gross Farm Income ($)	Net Farm Income ($)	Number Operations[1]	Reduced Net Farm Income[2]	Number Operations[1]	Reduced Net Farm Income[2]	Number Operations[1]	Reduced Net Farm Income[2]	Number Operations[1]	Reduced Net Farm Income[2]
Small Cash Crop	1320	33,000	8,400	65	3000	36	5900	29	7700	66	11,500[3]
Large Cash Crop	3860	98,700	25,300	37	9200	13	19,000	9	28,600	2	36,400
Crop & Livestock	3860	82,200	19,600	46	7300	21	15,700	12	24,400	9	52,300
Small Livestock	7200	125,900	13,900	10	5700	0	13,200	2	23,000	1	32,400
Large Livestock	12,790	188,200	1,700	3	3800	0	9,200	0	15,600	0	31,600
Extra Large Livestock	29,000	326,000	30,100	5	1500	0	28,100	0	19,300	0	61,000

Source: Economic Research Service, U.S. Department of Agriculture.

[1]Number of farm/ranch operations whose acreage would be reduced from 0-25 percent, 26-50 percent, 51-75 percent, and 76-100 percent respectively.
[2]Reduction per farm from present net farm income with 25 percent, 50 percent, and 100 percent reduction in farm/ranch acreage.
[3]The reduction in net farm income with 100 percent acreage reduction is more than present net farm income because it is assumed that the operations would maintain machinery and equipment until the land can be farmed again.

damage payments on the average would considerably exceed losses in agricultural income. Operators that have only leased land within the tracts would not be compensated for the lost leases.

On a regional basis, crop production losses during peak mining years amount to 1.6 percent of total production for those counties encompassing Alternative 6 tracts.

The 489 farm and ranch operations with lands affected in whole or in part by mining of tract acreage constitute 10.3 percent of the counties' total.

These losses would not significantly reduce regional agricultural production, nor would the agriculture support economy be affected. Within the overall structure of an agricultural economy subjected to fluctuations in supply and demand, interest rates, and weather cycles, the regional impacts associated with energy development within the Fort Union tracts are miniscule.

Woodson PRLA

Many of the impacts affecting agriculture have already been discussed in Alternative 3. Those impacts also would be expected to occur in relation to the PRLA. Only the changes in the impacts from Alternative 3 and the total impacts will be discussed.

Reclamation

In addition to those impacts discussed for Alternative 3, the disturbance of 5,195 acres within the Woodson PRLA tract under this alternative would involve .5 percent suitable plant growth material of good quality, 68.4 percent fair, 20.3 percent poor, and 10 percent unsuitable.

Sufficient suitable plant growth material of good to fair quality is available within the upper 60 inches of topsoil on the Woodson PRLA to respread tract areas disturbed during mining activities to a depth of 41 inches (see Table 3-21). For the PRLA and Alternative 3 the average respread depth would be 20 to 57 inches depending on the tract involved.

National Prime Farmlands have not been identified on the Woodson PRLA.

Land Disturbance and Production Losses

An average of 13 to 20 acres of cropland, excluding the acres of summer fallow, would be removed from production during each of the peak mining years of the PRLA (see Table 3-22).

Peak mining disturbance of 26 to 40 acres of hayland would result in an annual loss of 26 to 40 tons of hay production for the PRLA.

The 5,195 acres of disturbance proposed under the PRLA primarily would involve native prairie (93 percent).

An average of 1,766 to 2,684 acres of rangeland would also be removed from production during peak mining operation of the PRLA resulting in an average maximum loss of 353 to 537 AUMs. This option would have an average maximum loss of 11,417 to 12,919 AUMs resulting from removal of 28,597 to 34,868 acres of rangeland from production. This rangeland would be out of production ten to fifteen years.

Agricultural production on the PRLA averages from 15 to 40 percent of the combined total production of all livestock operators, similar to that of the Burns Creek tract.

TABLE 3-21
Suitable Plant Growth Material (SPGM)
Woodson PRLA

	Good			Fair			Poor			Unsuitable			Total			
	Acre Feet	Depth In.	%	Acre Feet	Depth In.	%	Acre Feet	Depth In.	%	Acre Feet	Depth In.	%	Acre Feet	Depth In.	%	Tract Acres
Woodson PRLA	180	0	0.47	25979	41	68.41	7699	12	20.27	4117	7	10.84	37975	60	100.00	7595
New Prod. Total	109786			339537			107129			130964			687415			137483
New Prod. Average		9	15.29		33	54.42		9	14.29		10	16.00		60	100.00	
Alt. Totals	238126			602763			135902			252310			1229100			245820
Alt. Averages		11	18.70		31	50.99		6	10.50		12	19.81		60	100.00	

TABLE 3-22
Vegetation Types
Woodson PRLA

	Cropland		Native Prairie		Wetlands		Woodlands		Other		Total	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
Alternative 3	118117	49.6	91428	38.4	8845	3.7	6702	2.8	13133	5.5	238225	100.0
Woodson PRLA	190	2.5	7099	93.5	35	0.5	239	3.1	32	0.4	7595	100.0
Grand Total	118307	48.1	98527	40.1	8880	3.6	6941	2.8	13165	5.4	245820	100.0

Approximately 120 total acres for the facility site associated with the PRLA would be taken out of agricultural production. In a worst case analysis 3,408 bushels of wheat would be lost annually for the life of the energy conversion facility. With the PRLA and Alternative 3 the acreage taken out of production would be 6,360 while 89,892 bushels of wheat would be lost annually for the life of the facilities.

Economic Influences on the Agricultural Community

Agricultural production losses in economic terms, and losses in net agricultural income (value) during peak mining, present value of these losses over the life of the mine, and present value of net agricultural income loss per million tons of coal mined for those additional agricultural operations within this alternative would be comparable to those applicable representative farm and ranch models analyzed for the nearby tracts in Alternative 3. Total tract losses would be proportionally comparable (47 percent) to those analyzed for the Burns Creek tract (see Fort Union Coal: Agricultural Economics, Tract Reports, December 1981).

Meridian Exchange Proposal

Many of the impacts affecting agriculture have already been discussed in Alternative 3. Those impacts also would be expected to occur in relation to the Meridian exchange. Only changes in the impacts and the total impacts will be discussed. There is no difference shown between an initial facility and a larger facility because the disturbance would be the same but over a different time frame. Therefore this discussion will address the total disturbance resulting from a single facility and the disturbance from two facilities.

Reclamation

The 29,169 acres of disturbance proposed for the Meridian tract in full production and the 31,922 acres proposed for the BLM tract, under this alternative, would involve 32 percent good and fair quality suitable plant growth material for the Meridian tract and 34 percent for the BLM tract.

Sufficient suitable plant growth material of good to fair quality is available within the upper 60 inches of topsoil on the Meridian and BLM tracts to respread tract areas disturbed during mining activities to a depth of 19 to 20 inches (see Table 3-23).

National Prime Farmlands have not been identified within either the Meridian or BLM tract.

Land Disturbance and Production Losses

The total additional annual disturbance during peak mining years within the Meridian and BLM areas is 859 and 901 acres respectively, somewhat more than that acreage presently left bare annually due to summer fallow (303 and 147 acres) in the dryland farming cycle.

TABLE 3-23

Suitable Plant Growth Material (SPGM)
Meridian Exchange

	Good			Fair			Poor			Unsuitable			Total			
	Acre Feet	Depth In.	%	Acre Feet	Depth In.	%	Acre Feet	Depth In.	%	Acre Feet	Depth In.	%	Acre Feet	Depth In.	%	Tract Acres
Alternative 3 AVGS.	22156	11	18.9	53,718	27	45.8	17,013	9	14.5	24,423	12	20.8	1,407,720	60	100	281,544
Meridian	11,964	4	7.0	43,047	15	25.1	78,444	27	45.7	38,240	13	22.3	171,695	60	100	34,339
RUNNING AVGS.	12,606	9	15.8	36,679	28	46.1	15,188	11	19.1	15,163	11	19.0	716,720	60	100	143,344
AVG. FOR TOTAL (Single facility)	24,179	12	19.2	59,334	28	47.1	16,546	8	13.1	25,782	12	20.5	1,258,405	60	100	251,681
BLM	15,321	5	8.5	46,225	15	25.6	61,026	20	33.9	57,683	19	32.0	180,255	60	100	36,051
RUNNING AVGS.	12,877	9	14.4	37,634	25	42.0	19,772	13	22.0	19,415	13	21.6	896,975	60	100	179,395
AVG. FOR TOTAL (2 facilities + Alternative 3)	23,374	11	17.9	58,142	27	44.5	20,590	9	15.7	28,682	13	21.9	1,438,660	60	100	287,732

An average of 245 to 372 acres of cropland, excluding the acres of summer fallow, would be removed from production during the peak mining years for a single facility and would result in an average maximum annual loss of 6,949 to 10,565 bushels of wheat (see Table 3-24). For two facilities the loss would be 8,510 to 12,938 bushels resulting from the removal of 300 to 456 acres from production. When combined with Alternative 3, the average maximum annual loss of 505,459 to 590,711 bushels of wheat would result from removal from production of 18,736 to 26,632 acres. Peak mining disturbance of 159 to 241 acres of hayland would result in an annual loss of 159 to 241 tons of hay production for both the single and double facility development. The result of this mining disturbance and that in Alternative 3, a total of 5,628 to 5,710 acres, is the annual loss of 5,268 to 5,350 tons of hay production.

An average of 8,048 to 12,232 acres of rangeland would also be removed from production during peak mining operation for the single facility resulting in an average maximum loss of 2,173 to 3,303 AUMs. For two facilities, the loss of 4,487 to 6,820 AUMs would result from 16,619 to 25,260 acres of rangeland being removed from production. The two facilities included with Alternative 3 would have a loss of 17,375 to 21,535 AUMs resulting from the removal of 48,861 to 64,785 acres of rangeland from production.

Agricultural production on the tract averages approximately from 15 to 40 percent of the combined total production of all livestock operators, similar to that of the Circle West III tract.

Approximately 160 total acres would be taken out of agricultural production for a single facility site, 320 total acres for two facility sites, and 8,480 total acres when two facility sites are combined with Alternative 3. The worst case analysis of these acreage losses for the life of the facilities would be the loss of 4,544 bushels, 9,088 bushels, and 121,704 bushels of wheat respectively.

Economic Influences on the Agricultural Community

Agricultural production losses in economic terms, and losses in net agricultural income (value) during peak mining present the value of these losses over the life of the mine, and present the value of net agricultural income loss per million tons of coal mined for those additional agricultural operations within this alternative would be comparable to those applicable representative farm and ranch models analyzed for the nearby tracts in Alternative 3. Total tract losses would be proportionally comparable (164 percent single facility/337 percent two facilities) to those analyzed for the Circle West III tract (See Fort Union Coal: Agricultural Economics, Tract Reports, December 1981).

TABLE 3-24

Vegetation Types
Meridian Exchange

	Cropland		Native Prairie		Wetlands		Woodlands		Other		Total	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
Alternative 3 w/o Circle West III	117,453	54.0	71,690	33.0	8,374	3.8	6,702	3.1	13,123	6.1	217,342	100.0
Meridian	1,919	5.6	32,191	93.7	195	0.6	0	0.0	34	0.1	34,339	100.0
TOTAL (1 facility)	119,372	47.4	103,881	41.3	8,569	3.4	6,702	2.7	13,157	5.2	251,681	100.0
BLM	369	1.0	34,287	95.1	1,356	3.8	0	0.0	39	0.1	36,051	100.0
TOTAL (2 facilities)	119,741	41.6	138,168	48.0	9,925	3.4	6,702	2.3	13,196	4.6	287,732	100.0

Summary

Short term disturbance of tract acreage during peak mining years and for ten to fifteen years during reclamation would somewhat exceed that acreage presently left bare annually due to summer fallow in the dryland farming cycle. Sufficient suitable plant growth material of good and fair quality is available, overall, for respreading of disturbed areas to an average depth of 16 to 53 inches depending upon the tract involved. Preliminary indications from completed and ongoing research are that, in the long term, agricultural productivity of mined land can be restored.

Individual operators may be severely impacted; however, compensation from rental, bonus, royalty, and damage payments on the average would considerably exceed losses in agricultural income. Operators that have only lease land within the tracts would not be compensated for the lost leases.

On a regional basis, crop production losses during peak mining years amount to approximately one percent of the total production for those counties encompassing the coal tracts under the various alternatives.

Operations with lands affected in whole or in part by mining of tract acreage constitute less than ten percent of the counties' total (10.3 percent for Alternative 6).

These losses would not significantly reduce regional agricultural production, nor would the agriculture support economy be affected. Within the overall structure of an agricultural economy subjected to fluctuations in supply and demand, interest rates, and weather cycles, the regional impacts associated with energy development within the Fort Union tracts are miniscule.

WILDLIFE

Alternative 1

This alternative would have the least impacts to wildlife of all of the alternatives because there are no new facilities proposed and the mines are already developed. The impacts from increased human population would be insignificant, and the acreage of wildlife habitat destroyed would be considerably less than the other alternatives as the powerlines, roads, and other ancillary developments associated with new plant construction would not occur. No threatened or endangered wildlife species have been identified which would be affected by any alternative.

There would, however, be significant impacts to wildlife from the habitat destruction in this alternative. If the federal coal is not leased, mining still would occur in the surrounding area and wildlife habitat would be destroyed. If the federal coal is leased, the impacts would generally be more significant on an acre by acre basis than on the non-federal coal areas. Because the areas overlying Federal coal generally contain the more rough and broken topography, they are considered the most valuable to wildlife and in many regions of the west provide the majority of the wildlife habitat.

The federal coal areas to be mined contain the most significant upland wooded habitat in the entire West-Central planning unit. The Glenharold tract, the northern portion and Beaver Creek drainage of the Renner tract, and portions of the Underwood tract are where these high value habitats occur. The areas contain 34,421 acres of native prairie, 4,444 acres of wetlands, and 5,417 acres of woodlands. Most of these areas would be destroyed during mining if federal coal is not leased.

The destruction of any wetland would cause significant, long-term impacts to waterfowl, shore birds, and many other species of wildlife, and these impacts would be of international importance. Fewer waterfowl would cause a permanent decline in the waterfowl population and fewer birds to harvest throughout the entire Central Flyway, including parts of Canada, the United States, and Mexico. The destruction during mining of more than 4,000 acres of wetlands in this alternative would be a significant impact to waterfowl.

If successful reclamation occurs the impacts would be short term, 15 to 20 years; however, there is debate on whether reclamation of wetlands is possible. Ducks Unlimited has established some wetlands as has the U.S. Fish and Wildlife Service and state wildlife agencies. Throughout the West there are waterfowl areas that have been created as mitigation for the destruction of other wetlands. The Bureau of Land Management has taken steps to improve waterfowl production on ponds and reservoirs built for other purposes. None of these agencies or organizations has reclaimed wetlands after they have been mined. The U.S. Fish and Wildlife Service, Bismarck area office (1981), North Dakota Game and Fish Department (1982), and a BLM biologist (M. Hoffer 1981, personal communication) maintain that to date, successful reclamation of wetlands has not been demonstrated.

It is probable that adequate reclamation of these valuable wildlife habitats would be expensive, difficult, and time-consuming. Some efforts may not be successful and would be significant long-term impacts. The magnitude of the impacts would be determined by the quality and number of wetlands destroyed in the short term. Long term permanent impacts would be determined by reclamation success.

Destruction of woody draws and riparian areas would impact most wildlife species in the area. Sharp-tailed grouse, white-tailed and mule deer, racoons, and red fox are a few of the better known species that would be

affected. This alternative contains more than 5,400 acres of these unique and valuable habitats.

Reclamation of woody draws has not been achieved to date. The state of North Dakota will not allow surface mining of significant wooded areas until the mining companies can demonstrate that reclamation is possible. Tests are currently underway by mining companies in North Dakota and they are optimistic that reclamation is possible. If successful it could take 15-50 years for the mix of overstory and understory of trees, shrubs, forbs, grasses, litter and dead and downed material to develop the complexity and diversity necessary for the many species of wildlife that depend on these areas. With successful reclamation, including correct topography, the impacts would be generally short-term.

It would be desirable to compensate for wildlife losses by providing alternate off-site habitat. This habitat would be dedicated to wildlife in perpetuity. Mitigation would be accomplished by managing and increasing the wildlife carrying capacity of the off-site habitats.

Reclamation of the mined area itself is also misleading. Much of the remaining wildlife habitat occurs on soil that is unsuitable for farming due to topography and soil type. The mining company could spend several years reclaiming an area to wildlife habitat with somewhat gentler slopes and sometimes better topsoil. This could render the land suitable for farming. If farming did occur, it would be a permanent loss of habitat and become a significant, long-term impact to wildlife.

Mitigation for and in some cases improvement in wildlife habitat would also be possible by leaving portions of highwalls in strategic places to create cliffs and nesting habitat for raptors. Proper amounts of north and south slopes would influence the degree of exposure to prevailing winds, runoff patterns, and amounts of solar radiation all important to wildlife and wildlife habitat establishment. Creation of year-round ponds or lakes would have positive effects on all wildlife groups. Unless this is a permanent long-term creation of habitat, the benefits for wildlife would be minimal. Productive, high quality waterfowl areas could be created. For example, Sandusky (1978) reported 35 waterfowl broods on 242 acres of newly reclaimed strip-mine ponds in Illinois. With proper planning, strip mine pits could provide excellent fishing opportunities and they could be productive and of benefit to the general public with minimal management efforts. The amount of precipitation in this part of Montana and North Dakota could limit this option; however, where the coal seams are the acquifiers for underground water, excellent opportunities would exist after mining.

Alternative 2

Approximately 15,542 acres of native prairie, 621 acres of woodlands, and 2,391 acres of wetlands would be destroyed during mining. In addition, the destruction of various types of habitat would occur from the construction of two gasification facilities, one indirect liquefaction plant, and one electric power plant. The locations of these facilities will not be known until they are permitted by the states, but it is estimated that about 5,000 acres would be disturbed.

Destruction of native prairie would most severely impact sage grouse, pronghorn antelope and sharp-tailed grouse. As with wetlands and woody draws, adequate reclamation would make these impacts short-term. Reclamation of native prairie has achieved vegetative production equal to pre-mining conditions, but species mix and diversity has been more difficult to reach. However, it appears that reclamation would be adequate for wildlife and impacts would be short-term.

The primary factors determining the type and magnitude of people impacts are employment levels, the corresponding population influx, and the stability of the work force through time. The severity of the impact is directly proportional to the total number of non-local employees, the size of the construction force, and the rates of change in employment. These impacts would be compounded by the development of a number of projects simultaneously within the Fort Union region. Any human population increase is accompanied by additional hunting and fishing pressure, but the decided preference of mining personnel for these forms of outdoor recreation activities causes an additional increase beyond what would normally be expected for that incremental increase in population. For example, from 1971 to 1977 in Campbell County, Wyoming the mean number of recreation days per day of the hunting season increased over 240 percent for antelope and 143 percent for mule deer hunting (Wyoming Game and Fish, 1979, *in*: Streeter, et al., 1979). During this same period, the human population increased by only 112 percent (BLM 1978). The total fines levied annually for hunting violations in Campbell County, Wyoming, a region of active mining, increased 545 percent from 1972 to 1977 while the human population increased by only 112 percent (Wyoming Game and Fish Department, 1972-1977, *in*: Streeter, et al., 1979).

In Mercer County, North Dakota three coal mines were opened and three power plants were constructed and operated from 1970 to 1980. Table 2-8 in Chapter 2 indicates the increases in hunting and fishing that occurred there during that time period. Hunting and fishing pressure could be expected to increase significantly (two to three times) more than the population.

Poaching is the single most destructive activity according to many wildlife managers and mining industry personnel. In 1981, three game wardens estimated a 300 percent increase in poaching in Billings County, North Dakota, an area undergoing oil and gas explora-

tion; and arrests for game violations in 1978 in Mercer and Oliver counties, North Dakota, were disproportionately young people who were new to the area and associated with the coal mining and power plant construction (K. Sambor, personal communication).

Big game animals are particularly vulnerable because of their size and visibility, and numerous sources report incidences of mine workers shooting deer indiscriminately while traveling to and from work on a daily basis. The problem is compounded in areas where shift changes coincide with the feeding periods of dusk and dawn, and access and haul roads cross or come close to wildlife migration routes and feeding areas. In 1974 at the Redstone Mine in Pitkin County, Colorado, the severity of the problem prompted the county commissioners to require the mine operator to initiate mandatory busing of employees from local communities. The poaching dropped dramatically immediately after busing began (Colorado Division of Wildlife, personal communication, *in*: Streeter, et al., 1979). Providing increased funding to the Montana Department of Fish, Wildlife, and Parks and the North Dakota Game and Fish Department would enable them to increase their law enforcement and management efforts which would reduce these impacts.

As in the case of poaching, road kills could be a major contributor to direct mortality which would be aggrevated if access roads cross migration routes or shift changes coincide with big game feeding periods. In some areas road kills may have significant local impacts, for example, four of six mortalities of marked animals were caused by vehicles in a southeastern Montana study (Biggins, 1976). Occidental Petroleum Company prepared a wildlife management plan prior to developing an oil shale lease in Rio Blanco County, Colorado and concluded that the potential for mule deer road kills and poaching by future employees was large enough to warrant providing bus transportation for employees.

Reducing these impacts could be accomplished by seeding food plots away from the roads and out of sight. This could lessen both car-animal collisions and poaching. In critical areas, employees should be bused to and from work, and firearms prohibited on mining property.

With the increase in humans an increase in the number of domestic animals can also be expected, especially dogs and cats. Packs of free-roaming dogs have been known to attack and kill deer and other animals. This is particularly serious in the winter because of the weakened condition of the wildlife. Does and fawns are the primary victims (Houston, 1968). Packs of dogs eliminated a herd of 200 to 300 deer over a four to five-year period in a nonmining community near Vail, Colorado and over 170 deer were killed in the vicinity of Aspen, Colorado (Colorado Division of Wildlife, personal communication, *in*: Streeter, et al., 1979).

Acid rain could have severe irreversible impacts to fisheries, but this should not occur in eastern Montana and most of North Dakota because of the buffering contained in the soil. Also, Fort Union coal has a low sulfur content and does not contribute to acid rain as much as other coal. Further east and northeast, the soils are not nearly so well buffered and impacts from acid rain become more and more of a possibility. Compounding the problem is the fact that acid rain problems presently occur in northern Minnesota, Wisconsin, and parts of Canada. If Fort Union emissions drift over these areas, they could have national as well as international consequences.

If all of the mining and proposed facilities are developed at the same time, wildlife populations would be greatly reduced. Hunting, fishing, and other forms of wildlife-related recreation would have to be sought elsewhere during mining. The additional hunting pressure would have far reaching effects, for example, it would probably significantly increase elk hunting in western Montana. Poaching would doubtless be a problem spreading to the several Indian reservations in the Fort Union region. The time frame and magnitude of these problems is not known.

The attitude that all impacts would be short-term with successful reclamation is prevalent among many resource specialists and industry personnel. This is very misleading and only relates to the areas that would be mined. Throughout the history of the West, as towns developed and human populations increased, wildlife populations were severely reduced. This is evident in the areas around Salt Lake City, Denver, Ogden, Boise, Billings, or any of the other larger western cities. Urban sprawl destroys most of the habitat and harrassment drives wildlife from the remaining habitat. Urban sprawl occurs 20, 50, and even more miles from the population center and hunting pressures become intense. This leads to reduced bag limits and reduced seasons which greatly curtails recreational hunting opportunities. Competition for these resources becomes an important factor. This could occur in the Fort Union region with the projected population increases.

These losses of wildlife habitat and that destroyed by the end-use facility would be permanent, irreversible, and irretrievable as reclamation would probably never take place on these areas.

Taking water from shallow bays or from the upper end of any bay in Lake Sakakawea could have significant, adverse impacts. These areas are prime nursery and spawning areas for sport and forage fish. Significant numbers of larval fish and fry would be sucked up by the pumps. Locating pump intakes in deeper non-critical areas of the reservoir would reduce or eliminate most of the impacts to fisheries.

Alternative 3

This alternative contains almost 2,010 more acres of wetlands, 41,465 more acres of native prairie, and 664 more acres of woodlands than Alternative 2 and a total of 57,700 acres of native prairie, 4,401 acres of wetlands, and 1,285 acres of woody draws. These essential habitats would be destroyed during mining as would additional acreage from the construction and operation of four new power plants, three liquefaction plants, and one gasification plant, all with ancillary developments and activities. The location of the facilities would determine the significance of the impact. The impacts resulting from the increase in human population discussed in Alternative 2 would become more severe and important in this alternative.

The addition of the Truax tract to this alternative would not cause significant impacts to wildlife; however, the Circle III tract contains some of the most important wildlife habitat in the Fort Union Region. The destruction of this habitat would severly impact the high value pronghorn herd by destroying their winter range and year-round habitat. The pronghorns raised in this area disperse to other areas during the summer and fall, and mining this habitat would decrease the hunting opportunities over a much wider area than what is mined. Eleven known sharp-tailed grouse dancing grounds and a nesting complex of ferruginous hawks in and around the Circle III tract make this a very important and sensitive wildlife area. The area also contains winter mule deer and sage grouse habitat which would be destroyed, and a golden eagle nest occurs adjacent to the tract which could be adversely affected by the activity associated with mining. Unsuitability criteria have been applied with the exception of the area identified as ferruginous hawk nesting habitat; a determination on unsuitability will be made at a later date as more information becomes available.

The Burns Creek tract has not been adequately inventoried to apply wildlife unsuitability criteria. Adequate information may have been obtained by Mobil Oil Co; however, at the time of printing the information had not been provided for evaluation. Thus, the tract may be dropped from this leasing effort. The tract does contain excellent woody draws and native prairie. Wild turkeys, antelope, sharp-tailed grouse, and numerous other species occur and would be severly impacted by mining.

The most important wildlife habitat on the Werner tract, riparian habitat along Spring Creek and its tributaries, has been removed from leasing. If this is consequently mined, there would be significant, long-term impacts to wildlife. If the area is declared unsuitable for surface mining, the impacts would be insignificant. It is not known what will occur on this area and it cannot be addressed.

Taking water from shallow bays or from the upper ends of any bay in Fort Peck Reservoir and Lake Sakakawea could have significant adverse impacts. These areas are prime nursery and spawning areas for sport, commercial, and forage fish. Significant numbers of larval fish and fry would be sucked up by the pumps. Locating pump intakes in deeper non-critical areas of the reservoir would reduce or eliminate the significant impacts to fisheries.

The impacts from habitat destruction, reclamation possibilities, and increased population are discussed in Alternatives 1 and 2.

Alternative 4

All of the impacts that would occur in Alternatives 1, 2, and 3 would occur in this alternative. The magnitude would change because more wildlife habitat would be destroyed and the human population would be larger.

There would be 1,464 more acres of native prairie, 535 more acres of wetlands, and 878 more acres of woodlands mined than in Alternative 3, for totals of 58,471 acres of native prairie, 4,936 acres of wetlands, and 2,163 acres of woody draws in this alternative.

Impacts to mule deer would be considerably less in this alternative than in Alternative 3 because the Central Bloomfield tract would not be mined. This also reduces the reclamation difficulty associated with the rough topography on the mule deer winter range contained on this tract.

The inclusion of the Zenith tract in this alternative could cause significant long-term impacts to wildlife should the riparian habitat along the Heart River be mined. The river may be declared unsuitable for surface mining as an alluvial valley floor when the mine plan is developed. This would protect the wildlife values and eliminate the significant, long-term impacts resulting from the destruction of the riparian areas.

Alternative 5

Alternative 5 would generate many of the same impacts to wildlife as Alternatives 1, 2, and 3. There would be 16,131 more acres of native prairie, only 40 more acres of wetlands, and 46 more acres of woodlands mined in this alternative than in Alternative 4, for a total of 74,602 acres of native prairie, 4,976 acres of wetlands, and 2,209 acres of woody draws. The addition of the Redwater II tract would cause further destruction of habitat for the pronghorn antelope and sharp-tailed grouse. The sport fishing, popular with local residents, and spawning areas in the Redwater River would be destroyed during mining. If leased, the alluvial valley floor of the river could be declared unsuitable at the mining plan stage. This would remove the significant impacts to wildlife habitat.

A significant opportunity would exist in this alternative for mitigation if mining occurs. Reclaiming the Redwater River which is a significant local year-around recreation resource, into a series of waterfowl ponds and fishing areas could produce a regionally significant year-round recreation resource attracting people from throughout the country.

Alternative 6

Of all the alternatives, this alternative would have the greatest impacts to wildlife. There would be 27,492 more acres of native prairie, 2,057 more acres of wetlands, and 52 more acres of woodlands in this alternative than in Alternative 5, for totals of 102,094 acres of native prairie, 6,033 acres of wetlands, and 2,261 acres of woody draws.

The addition of the Redwater I and II tracts which contain valuable wildlife habitat and a sport fishery, the Zenith tract which contains crucial riparian habitat, the Southwest Glendive tract which contains excellent native prairie with at least seven known sharp-tailed grouse dancing grounds, and the North Wibaux-Beach tract which contains seasonal wetlands add significantly to the magnitude of the impacts discussed in Alternative 1 and 2.

The addition of these five mines coupled with three additional gasification plants, one electric power plant, and one indirect liquefaction plant compounded by the tremendous increase in the numbers of people and the severity of land use change would permanently alter wildlife resources in the region. Hunting, fishing, and other forms of outdoor recreation as they are known today, would not exist and would have to be sought elsewhere.

Woodson PRLA

In addition to the wildlife impacts that would result in Alternative 1 and 2, mining the Woodson tract would add significant wildlife impacts. This tract contains greater wildlife values than any tract in this analysis. The acreages of wildlife habitat that would be destroyed will not be known until a later date. Burns Creek and its north and south forks contain a multitude of high quality essential wildlife habitat, and all three creeks contain valuable woody riparian areas. In addition, there are approximately 14 woody draws leading into these creeks. There are four known sharp-tailed grouse dancing grounds on the tract, three immediately adjacent, and there are probably more. White-tailed deer, turkeys, pheasants, waterfowl, muskrats, and raptors are abundant on or near the tract. Eighty acres of cliffs with an active prairie falcon nest were declared unsuitable for surface mining (W. Mathews, personal communications). The birds would probably leave the area during mining, but the habitat would still be available after mining.

It is doubtful that an area this rich in vegetative structure, topography, and wildlife habitat diversity can ever be duplicated by reclamation to again support as much wildlife. Mining of this tract would have significant long-term impacts and be an irreversible commitment of wildlife resources.

Meridian Exchange

Development of the selected tracts north of Nelson Creek would significantly increase the adverse impacts to fish and wildlife described in Alternative 1 and 2. Over 23,000 acres of additional habitat could be impacted by mining. The unique dendritic silver buffaloberry coulee habitat type in the northeast section would be destroyed. This coulee system provides important spring-fall cover for deer and is a key component of the major sharp-tailed grouse breeding-wintering complex. Many species of birds depend on this type for nest sites; this system supports the greatest species diversity of all habitat in the area. Several major waterfowl production areas would be lost. The area supports an unusual variety and density of raptors, and seven species are known to nest in the area. Nesting areas are identified for the three raptors of greatest concern—the golden eagle, prairie falcon, and ferruginous hawk. Two major breeding-wintering areas for sharp-tailed grouse would be impacted (Thompson 1981). Impacts of the proposed liquefaction plant are as those described in Alternative 2. No threatened or endangered wildlife species are identified as residents in the proposed exchange area.

Development of the exchange tracts south of Nelson Creek would only moderately increase impacts as described in Alternative 1. Approximately 25,000 acres of habitat would be affected. This is primarily high value pronghorn antelope year-round habitat which provides and contains a population that contributes significantly to hunting district 650. Population loss through habitat destruction or human impact could reduce the hunting population by as much as 30%. No threatened or endangered wildlife species have been identified in this alternative.

Summary

The impacts to wildlife would be in two main areas. Habitat destruction of wetlands, woody draws, and native prairie would occur from mining and construction. Impacts from human population would increase, such as poaching and additional habitat destruction from increased housing and other community expansion. The impacts to wildlife would become more severe as more coal is mined and more facilities are constructed. Thus, Alternative 1 would have the least impact with Alternative 6 impacts so severe that wildlife populations and the recreation they provide would be permanently changed from what is known today.

CULTURAL FEATURES

Alternative 1

The development of this alternative will impact 119 known archaeological sites—99 prehistoric and 20 historic with 54% of the land surface still to be inventoried (see Table 3-25). When that is completed, an assumption can be made with 95% confidence that the number of impacted sites will range from 119 to 427. These comparative projections are based on figures that include tracts where site densities are among the highest in the region.

Based on current evaluation, 51% of the sites already recorded do not contain sufficient scientific information to make them eligible for the National Register of Historic Places. Therefore, they will present no obstacle to surface mining. However, there are sites already known and others that will likely be found that may require special attention, preservation, or mitigation to preserve important and irreplaceable scientific information.

Mining on the Glenharold tract jeopardizes important and irreplaceable cultural information. Mining impacts have already occurred in the vicinity of the tract leaving remaining undisturbed areas the last source for important prehistoric information. Because of its proximity to the Missouri River Valley and diverse topography which provides a range of exploitation strategies, the Glenharold tract was a heavy use area for prehistoric people. If information cannot be preserved by avoidance, it will have to preserved by a careful and complex data recovery plan.

The most efficient way to deal with the archeological sites on the Glenharold tract is through the development of a district eligible for the National Register of Historic Places. This would serve as a framework on which to base future decisions about archeological sites in the area. When the sites are treated as a unit it will be possible to evaluate and possibly eliminate conflicts well in advance of coal development.

Alternative 2

The development of this alternative will impact 115 cultural sites in addition to the 119 already discussed (see Table 3-25). Sixty-six percent of the land surface in the alternative is still to be inventoried. When that is completed, an assumption can be made with 95% confidence that the number of impacted sites will range from 234 to 766. These figures should be viewed as outlined in Alternative 1.

Based on current evaluations, 43% of the sites already recorded do not contain sufficient information to make them eligible for the National Register of Historic Places. Therefore, they will present no obstacle to surface mining. However, there are important sites that should be treated as outlined in Alternative 1.

Conflicts between archaeological sites and surface mining on the Dunn Center tract will jeopardize important and irreplaceable cultural information. Intensive and extensive collection of Knife River flint in the area over 10,000 years of prehistory make the area unique in the Northern Plains and the United States. Information from the tract is important to understanding prehistory in the Central and Northern Plains, Central Canada, and as far east as the Ohio River Valley.

Any acceptable mitigation of the impacts of this alternatract requires consultation between several state and federal agencies and a proposed developer. This can be handled most efficiently through a memorandum of understanding for the treatment of the sites. This would become a basic management tool for the sites on the

TABLE 3-25

Fort Union Region Known Cultural Sites by Type

	Lithic Scatters	Stone Circle	Stone Circle With Other Features	Other Habitation	Buried Site of Unknown Function	Stone Alignments and Cairns	Lithic Procurement and Cache	Homestead	Historic Refuse	Historic Mine	Historic Burial	Historic Limited Use Area	Total Sites	Projected Total Sites	Percent To Be Inventoried
Alternative 1*	27	42	8	13	1	6	2	12	2	4	2	0	119	119-427	54
Alternative 2	102	44	9	13	1	8	14	25	10	5	2	1	234	234-766	66
Alternative 3	126	44	9	14	1	11	18	33	10	5	2	3	276	276-1,016	72
Alternative 4	116	44	9	14	1	11	16	38	13	5	2	3	272	272-1,56	72
Alternative 5	129	46	9	14	2	11	16	42	13	5	2	3	292	292-1,185	75
Alternative 6	137	46	9	14	4	11	22	54	18	5	2	4	326	326-1,463	77
Woodson PRLA	4	0	0	0	0	1	0	1	0	0	0	0	6	6-30	87
Woodson PRLA + Alternative 3	130	44	9	14	4	12	18	34	10	5	2	3	282	282-1,046	75
Meridian Exchange Proposal															
Northern Portion	4	0	0	0	0	0	1	2	0	0	0	0	6	6-295	96
Southern Portion	7	0	0	0	0	0	1	2	1	0	1	5	17	17-267	85
Total	11	0	0	0	0	0	2	4	1	0	1	5	23	23-528	90
Total + Alternative 3	137	44	9	14	1	11	20	37	11	5	3	8	299	299-1,544	76

*Alternative 1 site types are included in the figures for Alternatives 2-6.

tract just as the determination of eligibility is a tool for the treatment of sites that are irreplaceable on the Glenharold tract.

Alternative 3

The development of this alternative will impact 42 known sites in addition to the 234 sites already discussed with 72% of the land surface in the alternative still to be inventoried (see Table 3-25). When that has been completed, an assumption can be made with 95% confidence that the number of impacted sites will range from 276 to 1,016. These figures should be viewed as outlined in Alternative 1.

Based on current evaluation, 45% of the sites already recorded do not contain sufficient information to make them eligible for the National Register of Historic Places. Therefore, they will present no obstacle to surface mining. However, there are important sites that should be treated as outlined in Alternative 1.

High site density on the Burns Creek tract will require considerable mitigation in the form of data recovery from archaeological sites; however, because of the nature of the sites, mining will not be prevented. On the Bloomfield tract, sites occur most frequently where mining activity is likely to begin, and this will require immediate attention to mitigation but will not prevent mining. The important sites on the Dunn Center and Werner tracts associated with quarrying Knife River flint and the unusual and diverse sites on the unique Glenharold tract must also be kept in mind when evaluating this alternative.

Alternative 4

The development of this alternative will impact 4 fewer archaeological sites than the 276 already discussed with 72% of the land surface in the alternative still to be inventoried (see Table 3-25). When that has been completed, an assumption can be made with 95% confidence that the number of impacted sites will range between 272 and 1056. These figures should be viewed as outlined in Alternative 1.

Based on current evaluations, 46% of the sites already recorded do not contain sufficient information to make them eligible for the National Register of Historic Places. Therefore, they will present no obstacle to surface mining. However, when evaluating this alternative, the important sites on the Dunn Center and Werner tracts associated with quarrying Knife River flint and the unusual and diverse sites on the unique Glenharold tract must be kept in mind.

Alternative 5

The development of this alternative will impact 20 known archaeological sites in addition to the 272 already discussed with 75% of the land surface in the alternative still to be inventoried (see Table 3-25). When that has been completed, an assumption can be made with 95% confidence that the number of impacted sites will range between 292 and 1,185. These figures should be viewed as outlined in Alternative 1.

Based on current evaluation, 46% of the sites already recorded do not contain sufficient information to make them eligible for the National Register of Historic Places. They will present no obstacle to surface mining. However, when evaluating this alternative, the important sites on the Dunn Center and Werner tracts associated with quarrying Knife River flint and the unusual and diverse sites on the unique Glenharold tract must be kept in mind.

Alternative 6

The development of this alternative will impact 34 known archaeological sites in addition to the 292 already discussed with 77% of the land surface in the alternative still to be inventoried (see Table 3-25). When that has been completed, an assumption can be made with 95% confidence that the number of impacted sites will range between 326 and 1,463. These figures should be viewed as outlined in Alternative 1.

Based on current evaluations, 45% of the sites already recorded do not contain sufficient information to make them eligible for the National Register of Historic Places. They will present no obstacle to surface mining. However, when evaluating this alternative the important sites on the Dunn Center and Werner tracts associated with quarrying Knife River flint and the unusual and diverse sites on the unique Glenharold tract must be kept in mind.

Woodson PRLA

The amount of land in this alternative still to be inventoried is approximately 87 percent (see Table 3-25). The PRLA will impact six known cultural resources. When inventory has been completed, an assumption can be made with 95 percent confidence that the number of impacted sites would approximate a range of 6 to 30. These figures should be viewed as outlined in Alternative 1.

Based on current evaluations, 66 percent of the recorded sites may not contain sufficient information to make them eligible for the National Register of Historic Places. They should present no obstacle to surface mining.

Should the PRLA be included in Alternative 3, the expected change would result in the addition of 6 to approximately 30 sites and result in an expected alternative range of 282 to 1,046. These figures should be viewed as outlined in Alternative 1.

Meridian Exchange Proposal

The amount of land still to be inventoried is approximately 90 percent for the total proposal. The proposal will impact 23 known cultural sites (see Table 3-25). When the inventory has been completed, an assumption can be made with 95 percent confidence that the number of impacted sites would be approximately 528. There would be no difference in the cultural impact from a small or full-sized synfuel facility for the northern portion of the exchange proposal. The northern portion would impact six known sites. The southern portion of the proposal would impact 17 known sites.

Based on current evaluations, approximately 75 percent of the recorded sites may not contain sufficient information to make them eligible for the National Register of Historic Places,and they should present no obstacle to surface mining. Site diversity is expected to be consistent with the Circle West III inventory.

Should the proposal be included in Alternative 3, the expected change would result in the addition of 23 to approximately 528 sites and result in an expected alternative range of 299 to 1544. These figures should be viewed as outlined in Alternative 1.

Summary

The number and type of sites for all the alternatives, including the Woodson PRLA and the Meridian exchange proposal, should present few obstacles to surface mining. However, there are sites already known, and others that will likely be found that may require special attention, preservation, or mitigation to preserve important and irreplaceable scientific information. There has not been enough regional sampling to determine what the cultural resource base is, such that a regional perspective on impacts could be given.

The Glenharold tract in Alternatives 1-6 and the Dunn Center tract in Alternatives 2-6 contain significant cultural resources. These tracts result in these alternatives having significant impacts. Alternatives 3-5 have approximately the same known and projected sites, and would be similar in expected impacts.

OTHER LAND USES AND VALUES

Alternative 1

Alternative 1 would perpetuate the existing situation. More consistant and logical blocking of mined areas, while disturbing more land, would make reclamation efforts easier to plan and may result in a better end result.

Alternative 2

The development of coal resources for energy would result in the displacement of existing use directly by mining the area and through the development of a facility and indirectly through the development of utility corridors and by stimulating growth in associated communities. The existing uses displaced by coal development are, in most cases, agricultural. Assuming reclamation can be successfully employed in mined areas, the direct displacement of agricultural use can be considered temporary; a period of ten to forty years. Displacement of existing use through indirect influences may or may not be temporary.

The effect of direct displacement of agricultural use is described in the Agriculture section of this document.

As communities grow, more use is made of transportation facilities of all kinds. Highway and rail use for the transportation of goods and services increase as communities grow, and rural roads become commuter routes. Streets in communities become crowded and parking areas scarce. The growth of communities stress other services as well, as decribed in the economic and social sections.

It is assumed that energy development will include the processing of coal on or near the mine site. The products, electricity or fluids, would be transported using either transmission lines or pipelines. These corridors would be studied in Montana using the corridor selection process described in the Utility-Transportation Corridor Study for Montana and would be subject to provisions of the Major Facility Siting Act in North Dakota. While a general relationship exists between the number of mines, the number of energy producing facilities, and the number of utility corridors required, the impact of those utilities cannot be regionally projected. The use of transmission lines and pipelines does, however, imply that transportation systems, particularly rail and highway transportation, used to take agricultural products to market, would not be impaired or displaced by the production of coal.

The increase in the population of a community results in not only a quantitative change in land use, but a qualitative change. Existing retail trade facilities such as stores and shops may be stressed through development of new commercial development. The emigration of a new working population implies not only an increased demand for goods and services but different forms of marketing. Existing stores in downtown areas may be jeopardized through physical constraints of parking space and building size. Development of shopping centers which solve these problems may result in a decrease in retail volume for the core of the community rather than an anticipated increase resulting in an entirely different focal area for the community.

The qualitative change to local residents is an individual and community problem that cannot be predicted on an alternative by alternative basis. The social and economic sections of this document indicate the extent of change communities are likely to experience.

Table 3-26 shows a theoretical worst case situation. More specific information would be required to make projections of impact. This study only indicates areas of concern for future studies. The additional traffic is estimated on the basis of peak employment by both the mine and facility and treated as though that peak would be reached at the same time by all mines and plants. If the operation is typical, work would be accomplished in two shifts, in which half the working force would travel to and from the site. The figure assumes that each employee would drive a vehicle, would not seek alternate routes to the work site, and would not be absent from the job by taking time off for vacation or illness. The worst section of road has been selected to illustrate these conditions. The number of cars a person would count per minute is provided to put the traffic volume at rush hour into understandable terms.

In Alternative 2 the capacity of the existing road system would not be exceeded.

Alternative 3

It is unlikely that the capacity of the existing road system would be exceeded but further study is indicated (see Table 3-27). An assumption that 60% of the work force for Dunn Center and Werner would originate in Dickinson implies stress on State Route 22. An alternate route (SR 8) was not considered. The assumption that 40% of the workforce would originate in Stanton implies stress on State Route 200 near Hazen. Portions of this highway in the vicinity of Hazen have been upgraded and baseline traffic diminishes on this highway from Beulah to the sites involved.

Alternative 4

The capacity of the existing road system is unlikely to be exceeded as noted for Alternative 2 (see Table 2-28).

TABLE 3-26

Traffic Analysis
Altemative 2 Peak Employment Period (1990)

Direction of Origin and Destination	Baseline*	Estimated Additional Traffic*	Expected Rush Hour Traffic	Percent of Capacity	Vehicles per Minute
SW to Bloomfield, MT SR 16	4150	7360	1252	62.6%	21
E to Bloomfield, MT SR 200	1220	4908	711	35.6%	12
I-94 to S. Wibaux, MT SR 7	860	15336	1986	99.3%	33
S to S. Wibaux, MT SR 7	980	1916	318	15.9%	5
S to Dunn Center, ND SR 22	1175	14880	1954	97.7%	33
W to Dunn Center, ND SR 200	2980	11920	1728	86.4%	29
S to Garrison, ND SR 83	2350	2556	508	25.4%	8

*AADT (Average Annual Daily Traffic)

TABLE 3-27

Traffic Analysis
Altemative 3 Peak Employment Period (1990)

Direction of Origin and Destination	Baseline*	Estimated Additional Traffic*	Expected Rush Hour Traffic	Percent of Capacity	Vehicles per Minute
EW&S to Circle West, MT SR 24	140	10952	1380	69.0%	23
SE to C. Bloom. & B.C., MT SR 16	4150	10808	1683	84.2%	28
S to Dunn, Cir., & Werner, ND SR 22	1175	18572	2416	**120.8%	40
E&W to Dunn, Truax, & Werner, ND SR 200	2980	15412	2165	**108.2%	36

*AADT (Average Annual Daily Traffic)

**Theoretically over capacity; a cause for concern if over 200% under the conditions of this study; indicates a need for a more detailed study in planning for development if over 100%.

TABLE 3-28
Traffic Analysis
Alternative 4 Peak Employment Period (1990)

Direction of Origin and Destination	Baseline*	Estimated Additional Traffic*	Expected Rush Hour Traffic	Percent of Capacity	Vehicles per Minute
S to Burns Cr., MT SR 16	4150	7360	1252	62.6%	21
I-94 to Zenith, ND SR 85	1175	13928	1835	91.7%	31

*AADT (Average Annual Daily Traffic)

Alternative 5

A section of State Route 16 between Glendive and SR 264 bears more detailed study (see Table 3-29). An assumption that 60% of the work force would originate in Glendive implies that the capacity of this two mile section of highway may be exceeded during rush periods. The capacity of other roads should not be exceeded except as previously noted under Alternative 2.

Alternative 6

The road from I-94 to North Wibaux-Beach should be studied in more detail (see Table 3-30). Most of the traffic to the work site would require use of this road and access from the north is poor and not related to large centers of population.

Access to this road is by I-94 which is unlikely to be seriously affected.

The capacity of other roads should not be exceeded except as previously noted under Alternatives 2 and 5.

Woodson PRLA

The effects of the Woodson PRLA would be similar to those of Alternative 3.

Meridian Exchange Proposal

The effects of the Meridian Exchange Proposal would be similar to those of Alternative 3.

Aesthetics

Alternative 1

The existing facilities in North Dakota influence approximately 4,800 square miles. This area has a rural/industrial character whereas the rest of the region has a rural character. Portions of the Schoolhouse tract are visible from Highway 49 and portions of the Center tract are visible from the town of Center. These views are not unexpected because of present and past coal mining activity and can be considered short term impacts. The other tracts are not visible from any significant viewpoints.

The disturbance of mining itself would be visible locally, and spoil piles would be the most distinctive feature. This is a temporary phenomenon if continuous mining and reclamation techniques are used. Though the "short term" impact may be as long as ten years, in terms of the total operation and all it implies, the effects of mining from the visual standpoint should be considered minor. In many areas no important observer positions exist. Those considered important are views

TABLE 3-29
Traffic Analysis
Alternative 5 Peak Employment Period (1990)

Direction of Origin and Destination	Baseline*	Estimated Additional Traffic*	Expected Rush Hour Traffic	Percent of Capacity	Vehicles per Minute
S to Bloom. & B.C., MT SR 16	4150	14480	2142	**107.1%	36
EW&S Cir. 3 & Redwater 2, MT SR 16	670	6192	828	41.4%	14

*AADT (Average Annual Daily Traffic)

**Theoretically over capacity; a cause for concern if over 200% under the conditions of this study; indicates a need for a more detailed study in planning for development if over 100%

TABLE 3-30
Traffic Analysis
Alternative 6 Peak Employment Period (1990)

Direction of Origin and Destination	Baseline*	Estimated Additional Traffic*	Expected Rush Hour Traffic	Percent of Capacity	Vehicles per Minute
S to Circle I&II, MT SR 24	140	12264	1544	77.2%	26
S to Redwater I, MT SR 200	670	5880	789	39.4%	13
I-94 to N.Wib/Beach, MT FAS 261	217	17040	2147	**107.4%	36
E to SW Glendive, MT SR 22	919	11040	1454	72.7%	24

*AADT (Average Annual Daily Traffic)

**Theoretically over capacity; a cause for concern if over 200% under the conditions of this study; indicates a need for a more detailed study in planning for development if over 100%

from towns, views from the interstate highway, and views from secondary roads. All facilities would be visible in the area surrounding them for a distance of five miles, or so, under the best conditions.

Alternative 2

Approximately 9,700 square miles would be influenced by industrial development; 4,900 square miles more than is currently influenced. In addition to the local effects of Alternative 1, a portion of the South Wibaux tract would be visible from Interstate Highway 94, a portion of the Dunn Center tract would be visible from Highway 200, and a portion of the Sakakawea tract would be visible from Highway 37 and Lake Sakakawea. These views can be considered short term impacts.

The effect on the Fort Union region would be that the character of the region would begin to change from rural to rural/industrial. This change can be viewed as either aesthetically desirable or undesirable depending upon the orientation of the observer. The change in one's perception does not require the activity to be visible at all times because the concept of the character of the landscape is pieced together from perceptual impressions. Intermittant views of an object build that concept of the land whether the object is directly in view or not. The influence of the stack of a power plant is much larger than the area from which it can be directly seen.

The area of influence selected from this study assumes that the siting of the plant will take advantage of the local relief to reduce plant visibility. The assumption has been made that at the distances involved a plant would not be noticeable to the casual observer once the major buildings were obscured by the topography of the area. Under some circumstances, therefore, the plume of a smoke stack would be visible in an area far in excess of the areas used for analysis. On occasion the visual influence from a single plant could affect as much as 5000 square miles. A 1000-foot plume is visible around the plant for approximately 40 miles.

Alternative 3

Approximately 8,800 square miles of area would be influenced by industrial development; 4,000 square miles more than is currently influenced and 900 square miles less than would be influenced under Alternative 2. In addition to the local effects of Alternative 2, the Truax tract would be visible from the town of Hazen. The landscape character in this vicinity includes orphan spoil piles from previous mining which can be considered insignificant.

Alternative 4

Approximately 8,000 square miles would be influenced by industrial development; 3,100 square miles more than the existing influence and 800 square miles less area than would be influenced under Alternative 3. Local effects on the landscape would be the same as under Alternative 3.

Alternative 5

The visual character of approximately 9,400 square miles, approximately 4,600 square miles more than is currently influenced and 14,000 square miles more than would be influenced in Alternative 4, would be influenced by industrial development. In addition to the local effects of Alternative 4, portions of the Redwater II tract would be visible from Highways 13 and 20.

Alternative 6

Approximately 9,900 square miles would be influenced by industrial development; approximately 5,000 square miles more than is influenced currently and 500 square miles more than would be influenced under Alternative 5. Local effects, in addition to those of Alternative 5 include intermittant views to portions of the SW Glendive tract from Highway 20S and views of portions of the N. Wibaux-Beach tract from Interstate Highway 94.

The town of Circle is likely to be strongly influenced by views of portions of the Redwater II tract and, for some residents, may make this community a less desirable place to live.

Woodson PRLA

Regional effects of industrial development would be the same as Alternative 3. Local effects include views to the Woodson PRLA from a county road in addition to the local affects of Alternative 3.

Meridian Exchange Proposal

Regional effects of industrial development would be the same as Alternative 3. Local effects in addition to those of Alternative 3 include views from Highway 20 and county roads to the Meridian exchange area.

RECREATION

Alternative 1

The levels of outdoor recreational participation in the region should none of the tracts be leased would be expected to increase gradually with no significant increases pending other energy related demands on the region. Should the bypass tracts be leased, it can be expected that the demand for outdoor recreational activities in the affected counties would remain high. Lake Sakakawea would remain a main source for water related recreation. This would be in keeping with the expected energy-related workforce demands for fishing, hunting, camping, picnicking, and sightseeing, with lower priority given to indoor activities (Streeter, 1979).

Using a short method of calculating an estimated demand for community recreational land use, the impacts of coal development in terms of community open space, neighborhood parks, and playgrounds is useful in identifying trends in community recreation demand per alternative. Based on expected population through the year 2005, the additional requirements for community recreational land are shown in Appendix J. This method of calculation gives long term needs for land allocation and does not reflect the short-term needs of the peak construction population. Overall, there are no additional community recreation needs indicated for this alternative.

Alternative 2

This alternative would result in the same type of recreational activities being pursued by the coal-related workforce as discussed in Alternative 1. These activities would be demanded in eastern Montana, primarily in Wibaux, Dawson, and Richland counties. An increase in demand on Fort Peck Reservoir for water related recreation should surface, and Theodore Roosevelt National Park may receive use from the coal related workforce of the Dunn Center tract. It has been noted that North Dakota visitors to the park camp longer than other visitors and account for 35 percent of the use in the Cottonwood Campground (Wickware, 1981). Peak occupancy of this campground was 77.7 percent for weekend use and 57 percent for weekday use in 1980.

The community recreational facilities would require approximately 775 acres of land beyond what would be needed for Alternative 1, through the year 2005. These demands are shown by community in Appendix J with the county demand in Table 3-31.

TABLE 3-31

Fort Union Region 1981-2005
Community Recreation Land Needs by County
(Acres)

	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Montana					
Dawson	20.40	49.40	21.25	44.20	68.00
McCone	5.10	NC	NC	4.25	31.45
Richland	61.20	47.6	62.90	NC	NC
Roosevelt	20.40	NC	NC	NC	NC
Wibaux	5.10	NC	NC	NC	NC
Custer	25.50	NC	NC	NC	NC
Fallon	6.80	NC	NC	NC	NC
Garfield	1.70	NC	NC	NC	NC
Prairie	1.70	NC	NC	NC	NC
Valley	3.40	NC	NC	NC	NC
Subtotal	151.3	166.70	153.85	175.95	250.75
North Dakota					
McKenzie	8.5	NC	NC	NC	NC
Ward	111.65	109.65	NC	NC	NC
Burleigh	255.75	NC	NC	NC	NC
McLean	16.15	17.2	NC	NC	NC
Mercer	22.95	29.25	NC	NC	NC
Morton	80.75	NC	NC	NC	NC
Oliver	5.95	NC	NC	NC	NC
Billings	187	NC	NC	NC	NC
Dunn	34	48.45	NC	NC	NC
Golden Valley	40.8	NC	NC	NC	NC
Stark	46.75	47.60	66.30	NC	NC
Subtotal	624.12	645.27	663.97	663.97	663.97
TOTAL	775.32	811.97	817.82	839.92	914.62

NC — No change from previous alternative.

Alternative 3

Outdoor recreational activities indicated in Alternative 1 would continue to be demanded by an increasing user population. A doubling of demand in Dawson County could be expected. Use of recreational areas in the

region would also increase. Theodore Roosevelt would experience some increase in visitation from the workforce at the Werner and Truax tracts. Lake Sakakawea and Fort Peck Reservoir would see increased use from water recreation users.

The community recreational land needs would double in Dawson County with a regional need of approximately 37 acres above Alternative 2 and a regional need for 812 acres (see Table 3-31). Community recreational land needs are in Appendix J.

Alternative 4

There would be an increase in demand for outdoor recreational activities as discussed in Alternative 1. The land-based community recreation would increase in Richland County and slightly decrease in Dawson County (see Table 3-31). This would result in an approximate total demand of 818 acres, an increase of 6 acres over the previous alternative. Community recreational land needs are shown in Appendix J.

Alternative 5

Demand for outdoor recreational activities would continue to increase as the regional workforce increases.

The regional demand for community recreation land is approximately 840 acres, an increase of approximately 22 acres (see Table 3-31).

Alternative 6

This alternative would place the greatest demand on the available recreational resources in northeastern Montana. There would be great potential for landowner-recreationist conflict. The demand would tax the available resource except for water-based recreation in Lake Sakakawea and Fort Peck Reservoir. The increase in users would tax existing recreational access throughout the region, even at Lake Sakakawea and especially at Fort Peck Reservoir.

Community recreational land needs would total approximately 915 acres for the region, an increase of 75 acres over Alternative 5.

Woodson PRLA

The outdoor recreation demand and the community recreational land demand would not significantly increase over the expected impacts addressed in Alternative 3.

Meridian Exchange Proposal

The increase in outdoor recreation demand and community recreational land requirements would double the impacts in and around Circle, Montana, as outlined in Alternative 3 and shown in Appendix J.

Summary

The cumulative effects of increased population and the demand for outdoor recreation can be realized as a numerical progression on a regional basis. the proximity of tracts to one another and the population they bring to the surrounding communities is the largest factor that can be useful in a trend analysis. With Alternative 3, the majority of impacts have been realized in North Dakota. The same may be said for Montana except for Alternative 6 where the number of tracts almost doubles from Alternative 5. Therefore, the North Dakota recreation impacts with Alternatives 3 through 6 and the Montana recreation impacts with Alternative 3 through 5 should be regarded as the most demanding on the outdoor recreation resource in this document. Alternative 6 would tax the resource further in Montana, and could result in demand in counties adjacent to those counties which are direct recipients of the population.

ECONOMIC CONDITIONS

The economic modeling contained in the Site Specific Analyses used the Mountain West Computer model and analyzed only the impacts from an individual plant and mine. The regional analysis was done using the MSO E/D model developed by North Dakota State University and assesses the inter-active effects of all plants and mines contained within each alternative. Because of this fundamental difference in the way these two analyses had to be conducted, it is not possible to add the individual impacts from the SSAs and obtain the same results contained in the inter-active regional analyses presented in the Regional EIS.

Alternative 1

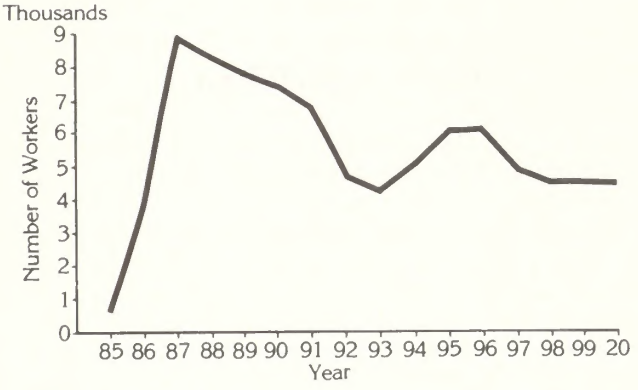
Economic conditions associated with Alternative 1 have already been described in Chapter II. Mining of the by-pass, production maintenance, and those tracts already being mined or scheduled for mining which do not require federal coal from the 1983 lease sale would not generate any additional employment, payroll, fiscal, or population growth over that already existing or forecasted to exist in the study area. Instead, the existing levels of employment, payroll, etc. would continue due to the long term availability of jobs in these areas. Chapter II describes in greater detail the existing and forecasted population, employment, income, and fiscal conditions within the study area. Because no additional economic impacts are associated with this alternative, mitigation would not be necessary.

Alternative 2

Alternative 2 differs from Alternative 1 primarily due to the total direct regional employment forecast shown in Figure 3-1. This peak employment level is approximately 9,000 higher than in Alternative 1 and would result in a significant population influx as people move into the area to obtain jobs. Comparison of the baseline forecast (dashed line) with the impact forecast (solid line) in Figure 3-2 (and associated Appendix G) for this alternative will show the incremental change from Alternative 1 to Alternative 2 in terms of population impacts. This alternative would result in impacts to the communities of Glendive, Richey, Sidney, Bloomfield, Circle, and Wibaux, Montana, and Zap, Dunn Center, Halliday, Killdeer, Garrison, Sentinel Butte, Beulah, and Beach, North Dakota.

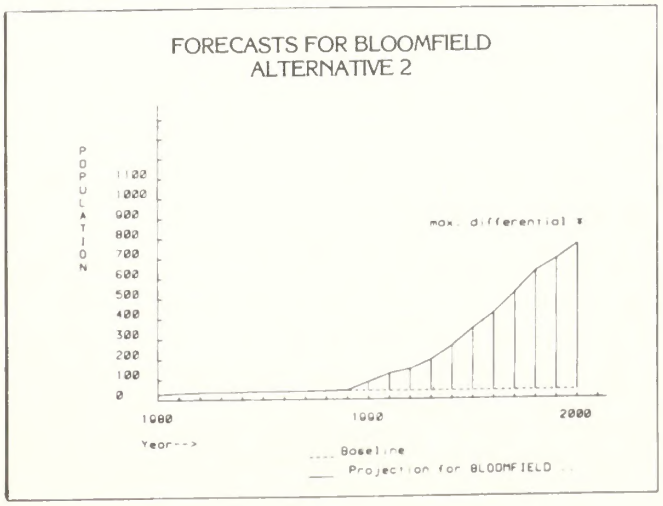
FIGURE 3-1

DIRECT* REGIONAL WORKFORCE—
ALTERNATIVE 2



*Includes direct workforce for mines and conversion facilities only.

FIGURE 3-2



Construction and operation of the mines and facilities would result in impacts upon several communities within the area as the result of population growth associated with employment opportunities. As an example, Figure 3-2 shows forecasted community population levels through 2005, both with and without development (baseline). See Appendix G for the additional communities affected by Alternative 2.

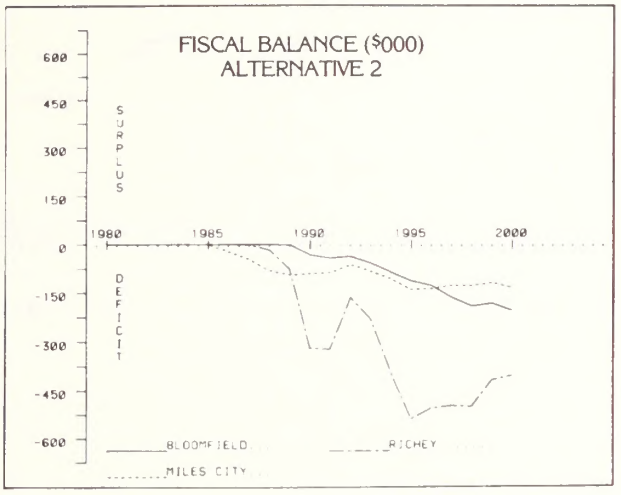
Changes in regional personal income from development are expected to be significant through the year 2005. The communities in which the workers and their families reside would experience some increases in economic activity as a result of employees payroll expenditure and through company expenditures for goods and services through the construction and operation phases. This alternative is forecasted to boost regional personal income by a maximum of 18 percent over baseline values by 1989 in Montana and 14 percent by 1987 in North Dakota as a result of expenditures associated with development.

Inflationary pressures would be felt in local communities as the demand for goods and services increases as a result of payroll and company expenditures in the area. Housing would probably be one of the hardest hit sectors in terms of increased demand brought about by population growth. It is likely that most of the communities mentioned above would experience overall increases in the general price level greater than that which would occur without development. The greatest impact from these price increases would be borne by those individuals who would not share in the income benefits from development, such as the elderly or those not suited for development-related work. In general, the communities discussed above which are expected to experience the greatest population growth would, other things equal, also experience the greatest degree of inflationary pressures.

Economic development of the type considered in this alternative could present severe public service funding problems for certain communities as they face rapid, development-related population increases. As an example, Figure 3-3 shows the communities which could experience fiscal fluctuations through the construction and operations phase as these communities are faced with service expansion and update. Appendix H shows the additional communities expected to experience fiscal impacts. The net fiscal balance data shown in the Appendix compares the forecasted revenues (e.g., property taxes, federal revenue sharing grants, highway funds, etc.) with the forecasted expenditures (e.g., police and fire, public service maintenance and expenditure, debt service, etc.) to arrive at an estimated yearly balance. There exist significant differences between North Dakota and Montana with respect to severance and conversion tax revenue allocations to counties and communities. The fiscal data from Montana do not reflect any coal board grants to Montana

communities since this is on an application/grant basis only and no assumptions can be made as to either the amount or timing of these grants. The severance and conversion tax distribution to communities in North Dakota is more predictable and the data for North Dakota communities do include the appropriate percentage of coal severance and conversion tax disbursements at the community level. The economic technical report describing the modeling effort will explain this in greater detail.

FIGURE 3-3



It should be noted that those communities which are forecasted to experience significant fiscal deficits could have problems in providing an adequate overall level of services. Additional funding, over and above that which would legislatively flow to the community as a result of economic development and/or population increases, would be necessary if the incoming population is to be provided with adequate public services. The question of which services would or would not receive funding cannot be answered at this time although it is likely that "basic" services such as police, fire, water and sewage treatment would receive priority over those services which are not essential to public health and safety (e.g., parks, recreation, and libraries).

Funding "lag" is a serious problem in almost all instances. This occurs when communities incur expenditures to accommodate population influxes prior to increased internal receipts becoming available from the tax rolls. Typically, this occurs during the "people intensive" construction phase when funding pressures are high in response to the need to expand public services but before the property, severance, and conversion taxes are available as revenue sources for the impacted communities.

It is very unlikely that any significant economic impacts would be felt by the Fort Berthold Indian Reservation from this alternative. The Indian economic concerns discussed in the West-Central EIS (BLM, 1978) by a representative of the Fort Berthold Reservation are still applicable for this level of development. Analyses of population impacts indicates that neither the Fort Peck, the Northern Cheyenne, nor the Crow Indian reservations in Montana would experience any noticeable impacts from this or subsequent alternatives. With no significant population increases, there would be no community service impacts (e.g., water, sewage, schools) or any impacts from trespass, traffic, or law enforcement problems.

As discussed earlier, economic and social impacts would occur at the regional, county, community, and personal level. There are many avenues to reducing or eliminating these impacts. Appendix I presents a more detailed discussion of the overall mitigation strategy and presents separate examples for North Dakota and Montana.

Presently the Montana Coal Board and the North Dakota Energy Impact Office are responsible for dispersing certain percentages of severance and conversion tax revenues to impacted counties and communities. These revenues are used by these entities to fund public improvement projects (e.g., sewer, water, police, etc.) in response to increased demands generated by development-related population increases.

Five important factors must exist for effective, efficient, economic, and social mitigation to occur: accurate information, adequate lead time, planning expertise, adequate financial assistance, and political leadership. These five factors are discussed in detail in Appendix I with emphasis on application in North Dakota along with a discussion on the mitigation aspects of technical and financial assistance with emphasis on application in Montana. Although no impacts are forecast for Indian reservations in the Fort Union Region, there is an overview in Appendix I of mitigation which could apply to Indian reservations in impact situations.

While the impacts described above are quantifiable to a great extent, there are several non-quantifiable economic impacts that should be considered as well.

As yet there are no definitive findings on economic cost of acid rain. These costs could occur through degradation of the national environmental and perhaps from increased health costs associated with acid rain. Until research better defines the full range of effects from this phenomena it is not possible to attach economic significance to this aspect of pollution. Similarly, any increased health cost associated with breathing conversion plant emissions are not well documented but could be significant.

Large scale economic development of the type analyzed in this EIS would create economic winners and losers. Primarily the losers would be those who do not share in the prosperity created by economic develop-

ment such as people on fixed incomes, people who do not own quickly appreciating assets (e.g., land, buildings, etc.), and those who would be impacted by development but not compensated for their losses. The winners would be those people who own land and buildings which would be in demand for development, wage earners gaining from higher energy related wage rates, and hence disposable incomes, and those compensated by the energy companies for development of their land or other resources.

The economic stimulus associated with plant and mine development has been referred to as the boom part of the boom/bust cycle. There are really two aspects to the boom portion of this cycle. The first is the two to three year peak construction phase which is the most intense part of the boom period. Often the end of the peak construction phase has been referred to as the bust part of the cycle because there is a significant reduction in the overall level of employment and spending. However, the long-term operations phase which occurs next continues for 30 to 40 years and represents a level of economic activity greater than that which would have occurred without plant and mine development. Communities can experience problems if they expand services to meet the peak construction phase workforce. After the peak construction workforce leaves, the community is faced with financing the capital intensive public service improvements which puts the burden on the people who remain in the community past the peak construction period. Economic uncertainties surrounding the optimum level of community service expansion are difficult for most communities to deal with and can result in excessive long-term obligations to the community's long-term residents.

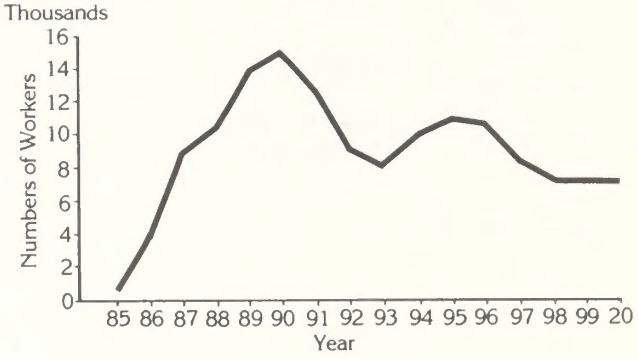
Alternative 3

The peak employment level for Alternative 3 is approximately 6,000 higher (i.e., 67 percent) than in Alternative 2 and would result in significant population influx as people move into the area to obtain jobs (see Figure 3-4). Comparison of Figures 3-5 and 3-6 (and associated Appendix G) for this alternative with those of the previous alternative will show the incremental change from Alternative 2 to Alternative 3 in terms of population and fiscal impacts. It is very likely that this alternative would result in additional impacts to the communities of Halliday, Dunn Center, Hazen, Zap, Circle, Terry, Sidney, Lambert, Jordan, and, especially, Glendive over and above those impacts associated with the previous alternative. This alternative differs from Alternative 2 by the addition of two facilities and mines in both Montana and North Dakota.

Development of the mines and facilities in Alternative 3 would result in impacts upon several communities within the region as the result of population growth associated with employment opportunities. As an example, Figure 3-5 shows the forecasted community population levels through 2005, both with and without development (baseline). See Appendix G for the additional communities affected by Alternative 3.

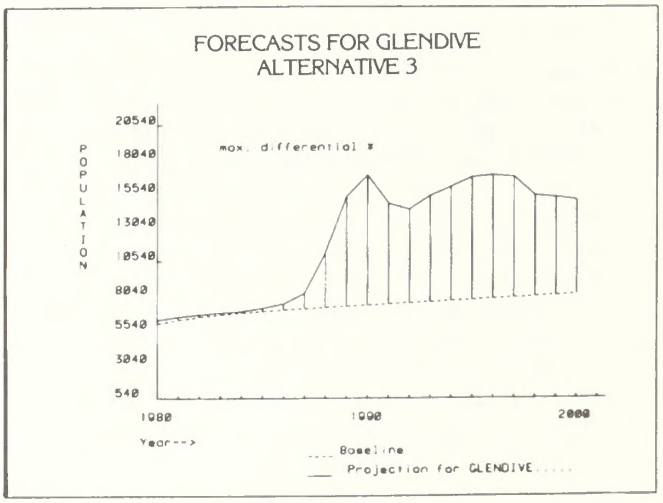
FIGURE 3-4

DIRECT* REGIONAL WORKFORCE—
ALTERNATIVE 3



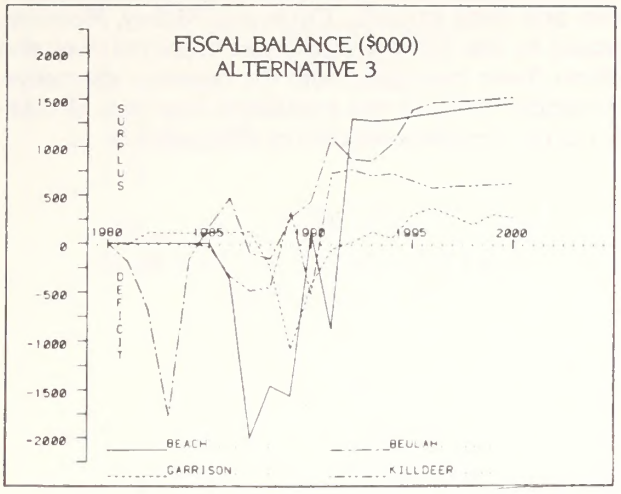
*Includes direct workforce for mines and conversion facilities only.

FIGURE 3-5



Changes in regional personal income from development are expected to be significant through the year 2005. The communities in which the workers and their families reside would experience some increases in economic activity as a result of employees' payroll expenditure and through company expenditures for goods and services through the construction and operation phases. This alternative is forecasted to boost regional personal income by a maximum of 32 percent over baseline values by 1990 in Montana and 14 percent by 1987 in North Dakota as a result of expenditures associated with the development.

FIGURE 3-6



Economic development of the type considered in this alternative could present severe public service funding problems for certain communities as they face rapid, development-related population increases. As an example, Figure 3-9 shows several communities which could experience fiscal fluctuations through the construction and operations phase as these communities are faced with service expansion and update. Appendix H shows the additional communities expected to experience fiscal impacts from Alternative 3. The net fiscal balance data shown in the appendix compares forecasted revenues (e.g., property taxes, federal revenue sharing grants, highway funds, etc.) with forecasted expenditures (e.g., police and fire, public service maintenance and expenditure, debt service, etc.) to arrive at an estimated yearly balance.

Discussions in Alternative 2 concerning inflation, funding lag, and Indian Reservation concerns apply to this alternative as well. Alternative 3 and Alternative 2 are the only alternatives which consider the same number of tracts and facilities in each state. However, it is likely that Montana would experience greater impacts from alternative 3 than would North Dakota because three of the four plants in Montana are synthetic fuel plants which have much greater capital expenditure and work force levels than do electric plants; only one of the four in North Dakota is a synthetic fuel plant.

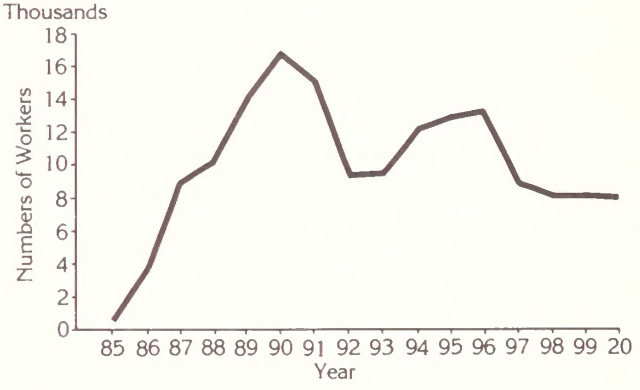
Mitigation of economic impacts would involve basically the same considerations among all alternatives. This range of impact mitigation possibilities is discussed in greater detail in Alternative 2 and in the appendix referenced in Alternative 2.

Alternative 4

There would be approximately 1,800 more (i.e., 12 percent) direct regional employees associated with Alternative 4 which would result in a significant population influx as people move into the area to obtain jobs (see Figure 3-7). Comparison of Figures 3-8 and 3-9 (and associated Appendix G) for this alternative with those of the previous alternative will show the incremental change from Alternative 3 to Alternative 4 in terms of population and fiscal impacts. Dickinson and Belfield, N.D. are the two communities most heavily impacted by Alternative 4. Impacts would be from the construction and operation of the Zenith facility and the associated mine south of these two towns.

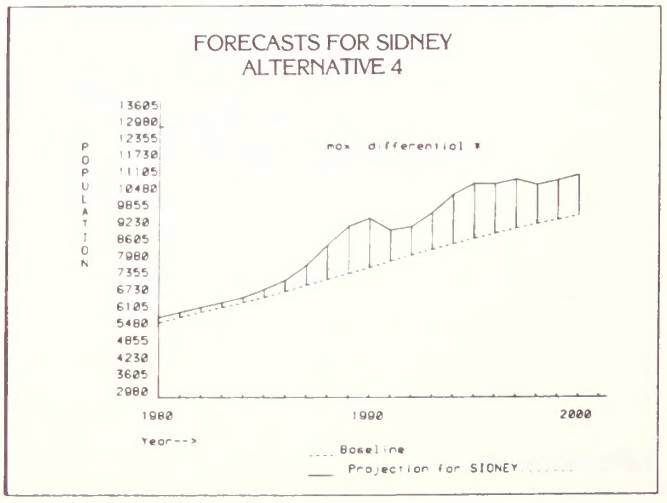
FIGURE 3-7

DIRECT* REGIONAL WORKFORCE—
ALTERNATIVE 4



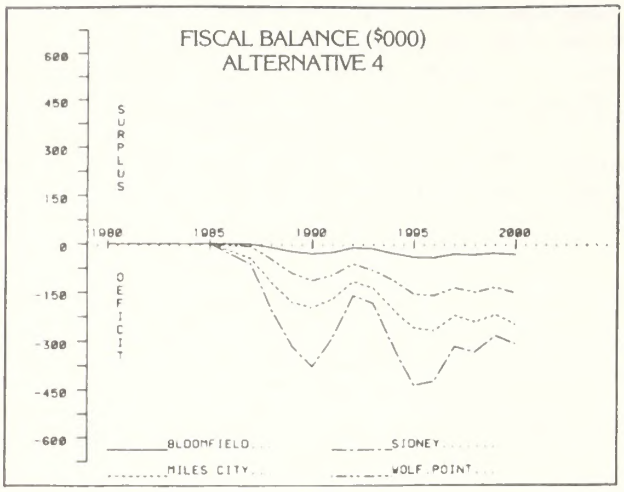
*Includes direct workforce for mines and conversion facilities only.

FIGURE 3-8



This alternative is forecasted to boost regional personal income by a maximum of 26 percent over baseline values by 1989 in Montana and 18 percent in North Dakota as a result of expenditures associated with development.

FIGURE 3-9



Economic development of the type considered in this alternative could present severe public service funding problems for certain communities as they face rapid development-related population increases. As an example, Figure 3-9 shows several communities which could experience fiscal fluctuations through the construction and operations phase as these communities are faced with service expansion and update. Appendix H shows the additional communities expected to experience fiscal impacts as a result of Alternative 4. The net fiscal balance data shown in the appendix compares forecasted revenues (e.g., property taxes, federal revenue sharing grants, highway funds, etc.) with forecasted expenditures (e.g., police and fire, public service maintenance and expenditure, debt service, etc.) to arrive at an estimated yearly balance.

The discussions in Alternative 2 concerning inflation, funding lag, and Indian reservation concerns apply to this alternative as well. The five synthetic fuel plants (three in Montana) and three electric generators (all in North Dakota) in Alternative 4 could create significant inflationary pressures in those communities shown in Figure 3-9 and Appendix H.

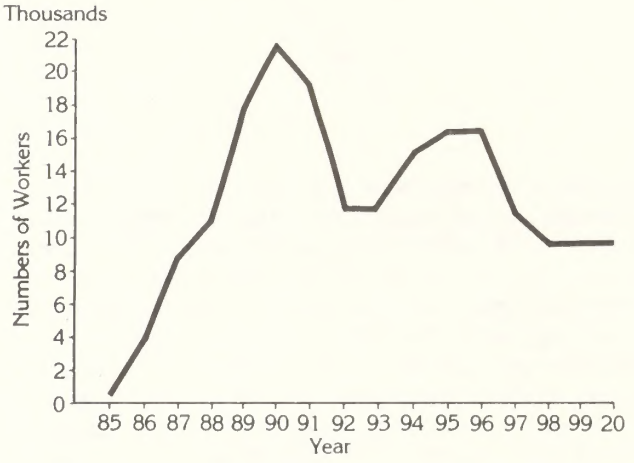
Mitigation of economic impacts would involve basically the same considerations among all alternatives. This range of impact mitigation possibilities is discussed in greater detail in Alternative 2 and in the Appendix referenced in Alternative 2.

Alternative 5

The peak employment level for Alternative 5 is approximately 4700 higher (i.e., 28 percent) than in Alternative 4 (see Figure 3-10) and would result in a significant population influx as people move into the area to obtain jobs. Comparison of Figures 3-11 and 3-12 (and associated Appendix G) for this alternative with those of the previous alternative will show the incremental change from Alternative 4 to Alternative 5 in terms of population and fiscal impacts. Circle and Richey, Montana, would be the communities most impacted over and above those associated with the previous alternative. Appendix G shows the population forecasts of additional communities affected by Alternative 5.

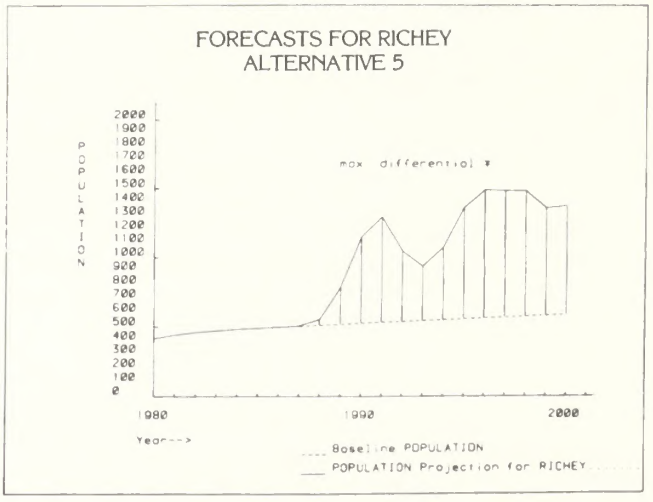
FIGURE 3-10

DIRECT* REGIONAL WORKFORCE—
ALTERNATIVE 5



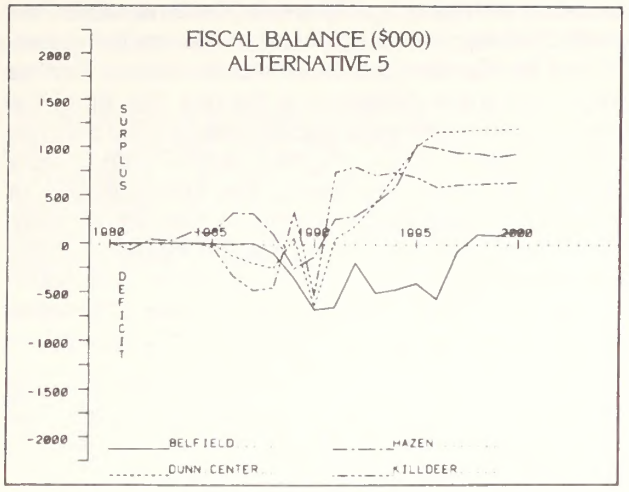
*Includes direct workforce for mines and conversion facilities only.

FIGURE 3-11



Alternative 5 is forecasted to boost regional personal income by a maximum of 38 percent over baseline values by 1989 in Montana and 18 percent by 1989 in North Dakota as a result of expenditures associated with development. This is in contrast to the 26 percent and 18 percent increase for Montana and North Dakota respectively discussed earlier in Alternative 4.

FIGURE 3-12



Economic development of the type considered could present severe public service funding problems for certain communities as they face rapid, development-related population increases. As an example, Figure 3-12 shows the communities which could experience fiscal fluctuations through the construction and operations phase as these communities are faced with service expansion and update. Appendix H shows the additional communities expected to experience fiscal impacts as a result of Alternative 5. The net fiscal balance data shown in the appendix compares forecasted revenues (e.g., property taxes, federal revenue sharing grants, highway funds, etc.) with forecasted expenditures (e.g., police and fire, public service maintenance and expenditure, debt service, etc.) to arrive at an estimated yearly balance.

The discussions in Alternative 2 concerning inflation, funding lag, and Indian Reservation concerns apply to this alternative as well. The six synthetic fuel plants and four electric facilities in Alternative 5 would generate significant inflationary pressures in those communities which would receive large population increases as a result of development.

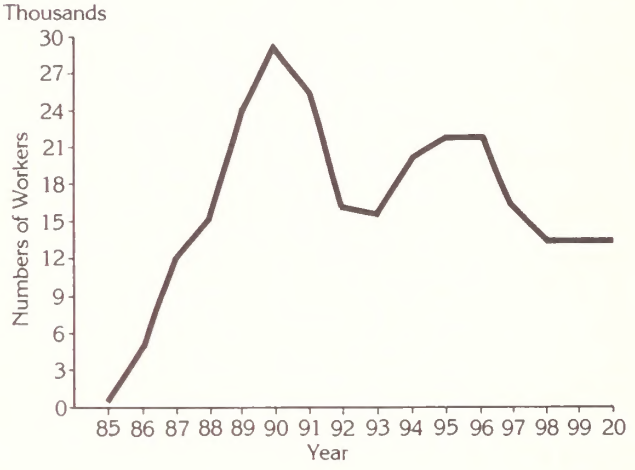
Mitigation of economic impacts would involve basically the same considerations among all alternatives. This range of impact mitigation possibilities is discussed in greater detail in Alternative 2 and in the Appendix referenced in Alternative 2.

Alternative 6

Alternative 6 differs from Alternative 5 primarily due to the total direct regional employment forecast for this alternative as shown in Figure 3-13. This peak employment level is approximately 30,000 direct workers for a total of 7,700 higher (i.e., 36 percent) than in Alternative 5 and would result in the largest population influx of any alternative as people move into the area to obtain jobs. Comparison of Figures 3-14 and 3-15 (and associated Appendix G) for this alternative with those of the previous alternative will show the incremental change from Alternative 5 to Alternative 6 in terms of population and fiscal impacts. This alternative would result in additional impacts to the communities of Lindsay, Terry, and, especially, the communities of Circle, Wibaux, Beach, and Glendive over and above those impacts associated with the previous alternative.

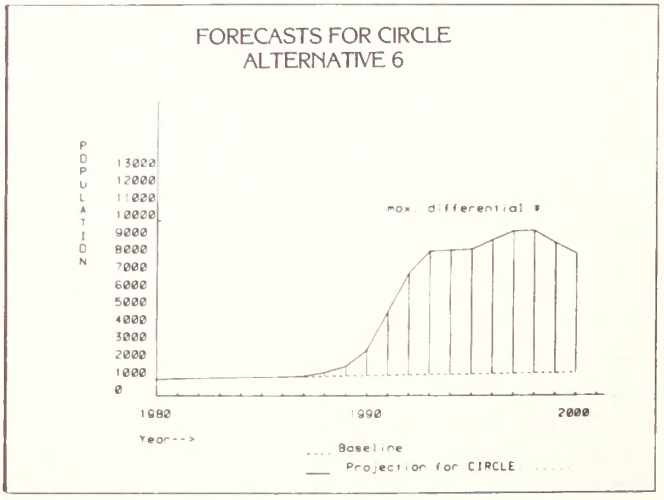
FIGURE 3-13

DIRECT* REGIONAL WORKFORCE—
ALTERNATIVE 6



*Includes direct workforce for mines and conversion facilities only.

FIGURE 3-14

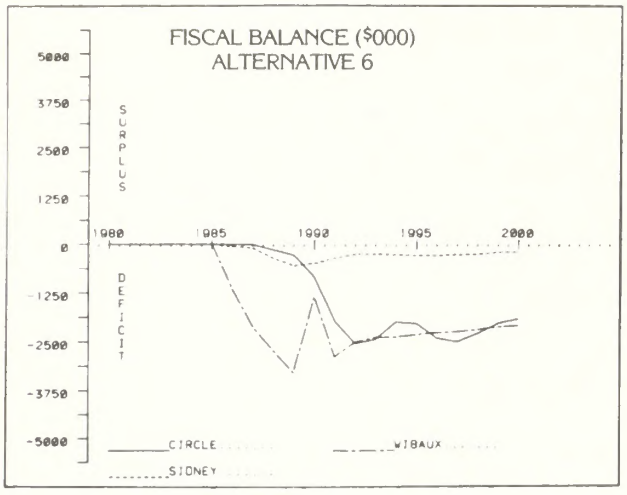


The construction and operation of the mines and facilities in Alternative 6 would result in impacts upon several communities within the region as the result of population growth associated with extensive employment opportunities. As an example, the forecasted

community population levels through 2005 are shown in Figure 3-14, both with and without development (baseline). Appendix G shows the population forecasts of additional communities affected by Alternative 6.

Alternative 6 is forecasted to boost regional personal income by a maximum of 47 percent over baseline values by 1990 in Montana and 20 percent by 1988 in North Dakota as a result of expenditures associated with the development of the 14 plants and mines in Alternative 6.

FIGURE 3-15



Economic development associated with Alternative 6 could present severe public service funding problems for certain communities as they face rapid, development-related population increases. As an example, Figure 3-15 shows three communities which could experience fiscal fluctuations through the construction and operations phase as these communities are faced with service expansion and update. Appendix H shows several additional communities expected to experience fiscal impacts as a result of Alternative 6. The net fiscal balance data shown in the appendix compares forecasted revenues (e.g., property taxes, federal revenue sharing grants, highway funds, etc.) with forecasted expenditures (e.g., police and fire, public service maintenance and expenditure, debt service, etc.) to arrive at an estimated yearly balance.

The discussions in Alternative 2 concerning inflation, funding lag, and Indian Reservation concerns apply to this alternative as well. However, the inflation pressures associated with Alternative 6 are likely to be the greatest of any analyzed because of the much greater company and payroll expenditures associated with this alternative. The communities in Figure 3-14 (and Appendix G) which would experience the greatest absolute growth in population would also be those likely to experience the greatest amount of inflationary pressures in the region.

This alternative contains the greatest disparity of any in terms of concentrating impacts in Montana rather than North Dakota; nine facilities and mines are being considered for Montana and five in North Dakota. Further emphasizing this difference is the fact that six of the nine in Montana are synthetic fuel plants while only two of the five are synfuel in North Dakota. From an economic and social standpoint, this concentration of people and capital intensive development would create extremely intense impacts in eastern Montana. (Note that this count includes both the North and South Wibaux-Beach facilities/mines in Montana, although a portion of the tract area does lie in North Dakota.)

Mitigation of economic impacts would involve basically the same considerations among all alternatives. The range of impact mitigation possibilities is discussed in greater detail in Alternative 2 and in the appendix referenced in Alternative 2. It is likely that mitigating measures necessary for Alternative 6 would be the most extensive required for any of the alternatives.

Woodson PRLA

The addition of the Woodson PRLA to Alternative 3 consists of the addition of a power plant and its associated mine. Figure 3-4 in Alternative 3 shows the total direct regional employment forecast for that alternative. The regional employment level associated with the Woodson PRLA is approximately 1,900 higher than in Alternative 3 (i.e., 12 percent). Sidney, Glendive, Savage, and Richey would be impacted over and above those impacts discussed under Alternative 3, although it is unlikely that this incremental change would create any significant marginal impacts over and above those already measured in Alternative 3.

Fiscal impacts associated with the Woodson PRLA are, for all practical purposes, much like those already discussed in Alternative 3 except that the communities of Sidney, Glendive, Richey, and perhaps Savage could sustain slighter higher forecasted deficits as a result of the construction and operation of the mine and facility associated with the Woodson PRLA.

The statements made in Alternative 2 concerning inflation, fiscal lag, mitigation, and Indian Reservation concerns apply equally to this discussion.

Meridian Exchange Proposal

Figure 3-4 in Alternative 3 shows the total direct regional employment forecast for that alternative. The peak regional employment level associated with the small synfuel plant is approximately 600 lower than in Alternative 3 (i.e., 4 percent reduction) and would result in a slightly smaller population influx into the area. This proposal would result in somewhat lower population impacts to the communities of Circle, Richey, and per-

haps Jordan as measured against those impacts discussed under Alternative 3. It is unlikely that this proposal would create any significant changes in addition to those already measured in Alternative 3.

Fiscal impacts associated with the proposal are, for all practical purposes, much like those already discussed in Alternative 3 except that the above communities could experience slighter lower forecasted deficits as a result of the construction and operation of the Meridian mine and associated facility.

Economic impacts from a full size synfuel plant are virtually identical to those described in Alternative 3. The workforce size, start dates, energy production data, and plan/mine location are all so similar that there would be no distinguishable difference between the two alternatives.

Economic impacts from the southern synfuel size tract are virtually identical to those decribed in Alternative 3. The workforce size, start dates, energy production data, and plan/mine location are all so similar that there would be no distinguishable difference between the two alternatives proposals.

Figure 3-4 in Alternative 3 shows the total direct regional employment forecast for that alternative. The peak regional employment level associated with two synfuel sized tracts is approximately 2600 higher than in Alternative 3 (i.e., 17 percent) and would result in an additional population influx as people move into the area to obtain jobs. This proposal would result in proportionally greater population impacts to the communities of Circle, Glendive, Richey, and perhaps Jordan over and above those impacts discussed under Alternative 3.

Fiscal impacts associated with this proposal are likely to be more intense than those already discussed in Alternative 3. The communities of Circle, Glendive, Richey, and perhaps Jordan could sustain higher forecasted deficits as a result of the construction and operation of the mines and facilities associated with two synfuel sized tracts.

The statements made in Alternative 2 concerning inflation, fiscal lag, mitigation, and Indian Reservation concerns apply equally to the Meridian proposal.

Summary

Although the Fort Union Region encompasses approximately 30 counties in western North Dakota and eastern Montana, there are only nine counties in the Region which would experience significant economic or social impacts: McCone, Wibaux, Richland, and Dawson counties in Montana and Mercer, Stark, Dunn, McLean, and Golden Valley counties in North Dakota.

The great majority of the economic and social impacts from Fort Union development result from population immigration due to development related to employment opportunities. Alternative 6 assumes the maximum level of coal development in the region and, consequently, carries the largest direct employment level of any alternative: approxmately 29,300 direct workers in the peak year of 1990. Alternative 2, however, has a much smaller workforce associated with it and, in general, a smaller level of economic and social impacts.

Those communities which are nearby the mine/plant site and which have a relatively large range of public and private services to offer would be the towns which would experience the greatest economic and social impacts as construction and operation workers relocate in response to employment opportunities.

SOCIAL CONDITIONS

Alternative 1

Since little population change is expected to occur in North Dakota or Montana as a result of the leasing of the production maintenance by-pass tracts, no major impacts to social organization or social well being would likely occur. The only effect of leasing on community services would be a continuation of the existing demand for facilities and services for the life of the particular mine.

Under a no leasing alternative, the impacts would be similar to those expected under strictly by-pass leasing, as it is assumed that coal companies would go elsewhere in the area to mine if they were not given access to federal tracts.

No significant impacts to members of the Fort Berthold Indian Reservation would be anticipated under this alternative.

Alternative 2

North Dakota communities affected most significantly will be those in Dunn, Golden Valley, and Billings counties; the communities of Hazen and Zap in Mercer County, and Garrison in McLean County. In Montana, communities receiving the most significant impacts to social organization and social well being will be Glendive, Richey, and Bloomfield in Dawson County. The overall impacts to the social organization in all the communities will be substantial, permanent, and intense while the impacts to social well being will be mostly of a short term nature, noticeable primarily during periods of peak construction.

The remainder of Mercer and McLean counties and the towns of Wibaux, Sidney, and Circle, Montana, will experience some significant impacts to the social organization and social well being although less rapid population peaks and lower relative growth will mean that the impacts will not be as dramatic. In Stark County and in the communities of Bismarck-Mandan, Dickinson, and Minot in North Dakota and Miles City, Wolf Point, Baker, and the remainder of Dawson and Richland counties in Montana, marginal population growth may cause some strain in the provision of social services but will cause no significant impacts to the social organization of those communities.

The impacts to the members of the Fort Berthold Indian Reservation would be minimal, as no significant population growth is expected to occur on the reservation itself. Positive impacts to social well being through increased job opportunities would be the most significant impact effecting reservation members.

Social Organization

In terms of impacts to social organization, all of the communities due to receive marked population increases would be subjected to large scale, chaotic disruptions in their social environments especially during peak construction periods.

One factor contributing to these changes, at least in smaller communities, will be the number and character of incoming worker populations. Large influxes of newcomers into rural areas will make it virtually impossible for longtime residents to know everyone in town, especially with a high turnover in transient workforce. In addition, the unfamiliar and sometimes unorthodox ideas and values and the outside ties that incoming populations bring with them will greatly expand the social diversity and complexity of smaller towns and could leave many longtime residents feeling like strangers in their own communities.

While integration of newcomers will be relatively easy in communities where rapid growth has occurred in the past, in many smaller communities traditionally characterized by low population turnover, assimilation of newcomers into the social environment could be more difficult. If conflict over the issue of development exists in a community, acceptance of newcomers may be particularly slow. Distrust of transient oil and gas workers in many towns may also carry over to workers associated with coal projects. Consequently, while informal interaction in most communities may be maintained between longtime residents, interaction with newcomers will likely be more formalized, creating the potential for conflict between established groups and newcomers.

With the magnitude of growth projected under this alternative, the pace of urbanization will be greatly accelerated especially in the more rural counties. In those towns where it has not yet happened, the formalization of business transactions, social service provisions, and governmental structures will likely occur. This trend toward a more bureaucratic, procedure-oriented community structure could leave many longtime users of public and private services feeling alienated from or perplexed by the new systems. Transitions in personal relationships such as these are likely to be some of the most distressing impacts that locals will have to deal with, especially in smaller communities where the social structure has remained relatively unchanged over the years.

Although some sense of social stability should reemerge during the operational phases of these projects, changes to the overall community character would be substantial and permanent with all affected communities losing a significant part of their rural flavor and undergoing permanent changes in their cultural and social environments.

The scale and complexity of the issues with which local governments will have to deal will also change, especially in communities with limited or no previous experience with growth. Community leaders could find themselves having to make controversial and unpopular decisions with regard to the distribution of limited public funds, the imposition of zoning and subdivision regulations, or a raise in tax rates to meet the growing needs for government services. Many of these management issues could spark conflict in rural communities where residents are traditionally fiscally conservative, where residents are split on the issues of development, and/or where newcomers are not well integrated into the social structure. If community leaders fail to act quickly and effectively to accommodate the needs and desires of major community groups, this conflict would be heightened.

An increase in the level of outside influences in impacted communities (e.g., federal government, national coal companies) will also occur especially in the more rural counties. The strengthening of outside links could prove to be a benefit for communities attempting to acquire loans or other grants for impact mitigation; however, loss of control to outside influences would ultimately affect the ability of locals to govern themselves. Any uncertainty surrounding anticipated developments in the region would further decrease the economic and political power locals would be able to exercise over their futures. The existence of other energy projects in the area requiring the attention of the local leaders would also affect the ability of the community to respond to impacts projected under this alternative.

Because the population influx is not expected to be significant on the Fort Berthold Indian Reservation as a result of development, alteration of the unique cultural characteristics of the tribes would not likely occur. With

an increase in population region-wide, however, more non-Indians may travel onto reservation lands for recreation or for other reasons which could lead to an increase in jurisdictional disputes on the reservation. Because the area around the reservation has been the scene of intense energy development activity in the past, many of the processes necessary for dealing with such impacts should be in place.

Social Well Being

Effects to social well being in those communities which receive only marginal population impacts will be slight (e.g., Bismarck, Dickinson). The greatest benefits in social well being will accrue to those people who are able to acquire employment or who benefit from business expansion as a result of the increased income in the community. These latter benefits will be confined largely to the regional trade centers of Bismarck-Mandan, Minot, Dickinson, and Miles City. Impacts to services and facilities and their provision should be confined to the peak construction periods (see Table 3-32). The need for short term emergency public assistance, an increase in use of medical, mental health, and recreational services, and an increase in the incidence, although not necessarily the rate, of crime will be the most significant negative impacts to community and personal well being (see Table 3-33—3-36). Residents of small communities which do not receive direct impacts may find themselves negatively impacted by the crowds, noise, and traffic that they will now have to deal with when making visits to the larger communities and cities for medical care or shopping.

TABLE 3-32

Peak Construction Years

	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Dawson	1990	—	1991	1990	1991
McCone	1990	—	—	1995	1997
Richland	1990	—	—	—	—
Wibaux	1987	1988	—	—	1989
Custer	1989	1990	—	—	1989
Burleigh	1996	—	—	—	—
Morton	1996	—	—	—	—
McLean	1990	—	—	—	—
Mercer	1999	1994	—	—	—
Dunn	1988	1990	—	—	1995
Stark	1999	1987	1996	—	1997
Golden Valley	1989	—	—	—	—

TABLE 3-33

Police Officers

Net Excess or Deficit* in Staffing Requirements/County/Alternative at Peak Population** Level

County	Current Level	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Montana						
Dawson	20	-11	-23	-20	-35	-58
McCone	4	-2	-2	-2	-4	-17
Richland	33	+2	0	0	0	-1
Wibaux	4	+1	0	0	0	-17
Custer	23	-7	-8	-8	-8	-8
North Dakota						
Burleigh	32	-121	-121	-121	-121	-121
Morton	23	-42	-42	-42	-42	-42
McLean	25	-10	-10	-10	-10	-10
Mercer	13	-12	-17	-17	-17	-17
Dunn	4	-14	-18	-18	-18	-18
Stark	10	-49	-44	-60	-60	-58
Golden Valley	6	-15	-15	-15	-15	-10

NOTE: All deficit or excess figures in this section are measured at peak construction against current public service staffing levels.

(-) denotes net deficit for year of maximum differential in population (peak population).

0 denotes staff meets standard.

(+) denotes net excess.

*Based on standard of 2.1 officers per 1,000 population established by Eastern Montana Social and Community Task Force.

**Peak population levels vary by year between counties and between alternatives based on type and level of developments projected.

Impacts to social well being will be most pronounced in those communities which receive the greatest population increases such as communities in McLean, Dunn, Golden Valley, and Dawson counties. In communities such as Hazen, Zap, Glendive, and Sidney where energy development projects are currently underway, large resident work forces with energy-related skills are in place, a factor which will enhance the possibility that locals will be able to obtain employment on new projects. The ability of women to obtain employment in energy-related jobs will be dependent on training programs, availability of day care centers, and the hiring practices of the specific companies.

Since local trade and service firms will also likely be expanding to meet the needs of growing populations, increased rates of labor force participation should be available to women and youth in lower-paying jobs. The availability of local employment may allow some younger people to remain in their communities to work if they desire, reversing youth outmigration trends which currently characterize many rural areas. Job opportunities that will become available to locals with energy development have consistently been cited by residents of these communities as a major reason for

TABLE 3-34

Teachers

Net Excess or Deficit* in Staffing Requirements/County/Alternative at Peak Population Level**

County	Current Level	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Montana						
Dawson	195	0	-50	-38	-107	-246
McCone	44	0	0	0	-6	-97
Richland	206	-16	-16	-29	-26	-26
Wibaux	25	-1	-1	-1	-1	-80
Custer	191	+10	+4	+4	+2	+7
North Dakota						
Burleigh	769	-325	-325	-325	-325	-325
Morton	337	-146	-146	-146	-146	-146
McLean	185	-56	-60	-60	-60	-61
Mercer	134	-50	-92	-92	-92	-92
Dunn	63	-61	-101	-101	-101	-116
Stark***	289	-160	-77	-99	-99	-97
Golden Valley	36	-113	-114	-115	-115	-67

NOTE: All deficit or excess figures in this section are measured at peak construction against current public service staffing levels.

(-) denotes net deficit for year of maximum differential in population (peak population).

0 denotes staff meets standard.

(+) denotes net excess.

*Based on standard of 1 teacher per 18.2 students (aged 6-20 years).

**Peak population levels vary by year between counties and between alternatives based on type and level of development projected.

***Does not include private school teachers in baseline.

TABLE 3-35

Dentists

Net Excess or Deficit* in Staffing Requirements/County/Alternative at Peak Population Level**

County	Current Level	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Montana						
Dawson	8	+1	-2	-1	-5	-11
McCone	1	0	-1	-1	-1	-4
Richland	5	-2	-3	-3	-3	-3
Wibaux	0	-1	-1	-1	-1	-5
Custer	6	-1	-1	-1	-1	-1
North Dakota						
Burleigh	30	-6	-6	-6	-6	-6
Morton	9	-6	-6	-6	-6	-6
McLean	2	-6	-6	-6	-6	-6
Mercer	1	-5	-6	-6	-6	-6
Dunn	1	-3	-4	-4	-4	-4
Stark	10	-4	-3	-7	-7	-6
Golden Valley	1	-4	-4	-4	-4	-3

NOTE: All deficit or excess figures in this section are measured at peak construction against current public service staffing levels.

(-) denotes net deficit for year of maximum differential in population (peak population).

0 denotes staff meets standard.

(+) denotes net excess.

*Based on standard of 1 dentist per 2000 population.

**Peak population levels vary by year between counties and between alternatives based on type and level of developments projected.

favoring such development in their area (BLM 1980-81; REAP 1982). Whether or not locals actually acquire jobs may determine the effect that development will ultimately have on their sense of well being; however, many residents may derive satisfaction simply from seeing their communities prosper.

The increase in income which will accompany the increase in employment will enhance the well being and possibly raise the standard of living of those positively affected but could create disparity in groups or between individuals who will not benefit. In areas such as Dunn Center and Wibaux, which have especially large elderly populations, the communities can expect overall lower benefits from development.

Existing conflicts over development issues could influence the number of locals who actually capitalize on new business opportunities. However, where expansion of local businesses and facilities does occur, it would meet with the approval of those residents who have always felt that the lack of competition and a shortage of local retail establishments were major drawbacks of living in their communities. Crowds, traffic, noise, and other new side effects of growth that will become apparent both locally and in regional trade centers may make shopping less of an enjoyable experience.

Population growth would cause increased demand for public and private services of all types. In some cases the capacity of towns to respond would be overwhelmed, especially if services are currently inadequate or providers are not used to handling the types of problems which they will be encountering. This strain on services would reduce the availability or distribution of resources to longtime users and newcomers alike. The change in age/sex structure which will occur with the influx of large numbers of younger, energy-related workers could also affect the mix of service needs within a given community. If community services shift to accommodate the needs of these younger immigrants, the elderly and other user groups could experience a reduction in service provisions and, hence, a lessening of their sense of well being.

Medical personnel and facilities in all impacted communities, as well as in regional medical centers, may be strained and, in some cases, overwhelmed with population growth depending on the baseline adequacy of such services. These impacts would be confined primarily to the short term construction peaks. With the change in the age/sex structure, the nature of services offered may also shift from one of emphasis on care of chronic long-term ailments for the elderly to one with

emphasis on obstetric care and work-related accident care. Volunteer ambulance services in rural areas will also find their workloads increasing especially if coal mining companies do not have their own ambulance services. In communities where hospitals are currently underutilized, the influx of people may allow local hospitals to expand their support staff and increase the type of services offered. This expansion of services, along with any resulting increase in the number of doctors in rural communities, would ultimately benefit the local residents who, because of transportation or money limitations, find it difficult to travel outside of their communities for medical services.

An increase in mental health problems can be expected to materialize in all the communities impacted by large population influxes especially during the stressful peak construction phases of development. In many rural areas, particularly in Montana, lack of sufficient professional personnel to handle the increased caseload will mean existing services will be severely strained if additional personnel are not hired.

TABLE 3-36

PHYSICIANS

Net Excess or Deficit* in Staffing Requirements/County/ Alternative at Peak Population Level**

County	Current Level	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Montana						
Dawson	5	-7	-12	-10	-17	-22
McCone	1	-1	-2	-2	-2	-8
Richland	8	-4	-5	-5	-5	-8
Wibaux	0	-1	-1	-1	-1	-8
Custer	15	+3	+3	+3	+3	+3
North Dakota						
Burleigh***	88	+4	+4	+4	+4	+4
Morton***	1	+4	+4	+4	+4	+4
McLean	7	-7	-7	-7	-7	-7
Mercer	3	-7	-9	-9	-9	-9
Dunn	0	-7	-9	-9	-9	-9
Stark	26	+3	+5	-1	-1	0
Golden Valley	3	-5	-5	-5	-5	-3

NOTE: All deficit or excess figures in this section are measured at peak construction against current public service staffing levels.

(-) denotes net deficit for year of maximum differential in population (peak population).

0 denotes staff meets standard.

(+) denotes net excess.

*Based on standard of 1 primary care physician per 1,222 population established by Eastern Montana Social and Community Service Task Force.

**Peak population levels vary by year between counties and between alternatives based on type and level of developments projected.

***Burleigh-Morton area considered jointly. Does not consider Bismarck area doctors serving rural counties in baseline of these counties.

In communities where the school enrollment will be near capacity when the population impacts occur, the influx of younger, energy-related workers with school-age children will cause overcrowding in the local institutions, more students per teacher, and a more diffused level of student participation particularly during the short term peak construction phases. This problem of school crowding is a major concern of many parents and school administrators in both North Dakota and Montana where schools have traditionally provided a strong sense of community identification for rural areas. Many parents have, in past surveys, expressed concern about perceived increases of drug and alcohol use in schools in rapid growth communities. These parents may experience threats to their sense of family well being if the incidence or rate of such use rises locally. On the other hand, in communities where declining birth rates have meant declining school enrollments, the population influxes may serve to stabilize enrollments and allow communities to maintain existing personnel levels and expand their curriculum.

In all the communities affected by large population increases, the law enforcement staff and jail facilities will be impacted, sometimes beyond the capacity of the city or county to respond without the rapid addition of personnel and/or an increase in the amount of training that officers receive. These impacts to local law enforcement agencies will be primarily short term impacts with a drop in activity as the population begins to stabilize during the operational phases of development. While the incidences of crime and other problem behavior will increase with the growth in population in these communities, the overall rate of crime in an area may remain stable. Crime may suddenly become more visible to the public, however, and the perception of threats to personal safety and security will increase. It is, in fact, this perception of decreased safety that is consistently identified by residents of these areas as a major concern relative to coal development.

Those communities which independently expand service and facility levels to accommodate major short-term population influxes may face problems of a different nature when these peak work forces leave the area. Sharply declining tax bases and lowered service use may mean that long-term residents are forced to pay for facility expansions well into the future.

An increase in the number of strangers passing through town, noise, crowds, traffic, and other stresses will also occur. These disturbances will be particularly distressing for those residents who have never had to deal with such problems before. Although people will likely adapt to these changes, which will be most intense during peak construction phases, they may always regret the loss of the quiet, slow-paced small town atmosphere they previously enjoyed.

Many ranchers and farmers in the Fort Union region will perceive major threats to their social and economic well being if this alternative is implemented, threats which would likely be permanent ones. In smaller communities where they currently possess a measure of power and prestige, disparity in wage differentials and possibly a change in the power base caused by population growth could leave ranchers and farmers feeling estranged from the emerging community character.

Many area ranchers and farmers in the Fort Union region have organized in opposition to development because of their concern over regional impacts to air and water resources which they feel could affect their economic and social welfare and ultimately limit their future options. Many agricultural producers are not convinced that the coal in the Fort Union region is needed to meet national energy goals or that the successful reclamation of agricultural land can be guaranteed. They may consequently feel that regional coal development has compromised their well being for the benefit of business interests in town. This feeling of powerlessness could lead to conflict in some areas between various community groups who may be sharing unequally in the costs and benefits of development. If this happens, the well being of the community as a whole would suffer.

Because population growth on the Fort Berthold Indian Reservation is not expected to be significant, impacts to the social well being of reservation members will be minimal. Positive impacts to social well being will be most apparent if members of the tribes are able to acquire employment on energy projects. Because efforts are being made statewide to train and prepare Native Americans for employment on such projects, the potential for positive impacts should be enhanced. With increased employment opportunities, Indians who may have had to leave the reservation to look for work may find they are able to stay in the area.

Impacts to services and facilities on the reservation itself will not likely occur; however, because of impacts due to occur regionwide to service and facility provision, Indians may find themselves negatively impacted if they travel off the reservation for shopping, medical services, etc. The increased traffic, crowded conditions, and other stressful situations they will encounter could make such trips unpleasant. These conditions would be most noticeable during the peak construction periods.

Alternative 3

Social impacts in many communities will increase in intensity under Alternative 3 development. Circle, Terry, Jordan, Lambert, and Wolf Point in Montana will all receive more rapid and more substantial population growth which will cause a proportional increase in the intensity of social impacts. The most significant impacts, however, will still occur in the communities of Dunn Center, Killdeer, Halliday, and Hazen in North Dakota and Bloomfield, Richey, and Glendive in Montana where the timing and size of incoming work forces is also accelerated. In all other communities in the Fort Union region, impacts under Alternative 3 will be similar to those forecasted under Alternative 2.

Impacts to the members of the Fort Berthold Indian Reservation would be similar to those forecasted under Alternative 2.

Social Organization

The communities of Circle, Jordan, Terry, Lambert, Wolf Point, and Sidney, Montana, will experience impacts to their social organizations similar to those outlined in Alternative 2. Because of an increase in the rapidity of growth projected for these communities under Alternative 3, it is very likely that the degree of change and the rate at which it occurs will be accelerated.

In communities such as Hazen, Dunn Center, Bloomfield, Richey, and Glendive where the construction period will peak sooner and with greater force, the community may find that its ability to respond to growth is even more severely handicapped than it would be under Alternative 2 where growth was generally more gradual. The more rapid influx of larger numbers of workers will mean that the processes of urbanization, formalization of personal and business interactions, and loss of identity with the community will be stepped up with the potential for conflict between newcomers and established residents heightened. More pressures will likely come to bear on community leaders as they attempt to prepare the community for growth. This will be especially true if fiscal and other resources are limited or unavailable, or if uncertainty surrounding the project prevents leaders from responding quickly and decisively enough to the changes.

In addition, the development of several new tracts and associated facilities under this alternative will mean that communities such as Killdeer, Halliday, Circle, and Sidney will now be required to plan for two peak construction periods. The existence of a second peak construction period may actually be beneficial for these communities if they use the interim period between peaks as a time to re-evaluate their situation and prepare to capitalize on the more positive benefits of development; however, the appearance of two peak phases can mean that the short-term, most chaotic construction period will be prolonged.

Up and downs in peak population also make it more difficult for planners and administrators to set policy and to find a good balance between long range conservative fiscal spending and an adequate response to their community's needs. The introduction of more

than one multi-national coal company into the community will also increase the amount of outside influences in local communities and complicate further the types and complexity of issues with which local leaders will have to deal.

Impacts to members of the Fort Berthold Indian Reservation will be similar to those predicted under Alternative 2.

Social Well Being

For many communities in the Fort Union region, impacts to social well being will be similar to those anticipated under Alternative 2. For those communities which will be receiving greater numbers of workers in a shorter time period (Dunn Center, Killdeer, Halliday, Hazen, Glendive, Richey and Bloomfield), impacts to social well being will be even more significant under Alternative 3 (see Table 3-32). The difference in impacts will generally be ones of degree, not of kind.

Because employment needs will grow under this alternative, more locals will be in a position to benefit through the acquisition of higher-paying jobs. More opportunities for women and youth to gain local employment will also be available. The social well being of residents who have the skills to obtain employment and of those who want to see the local economy grow through the introduction of jobs and new and expanded businesses and services will be more positively affected under this alternative.

Increased demands on public and private services would be felt even more intensely under Alternative 3 for most communities including regional trade and service centers (see Tables 3-33—3-36). The strains on services would become apparent more quickly and probably last longer than under Alternative 2. A more defined change in age/sex structure in communities such as Dunn Center and Circle, with their present large elderly populations, would occur, possibly affecting the mix of services offered, especially during peak construction periods.

As the population levels increase in many communities under this alternative, some of the public and private facilities such as hospitals and schools, which may have been just adequate for Alternative 2 growth, will now also be overwhelmed. This could result in larger numbers of displaced people and greater feelings of hostility toward newcomers and community leaders.

Pressures on law enforcement agencies, mental health services, and recreational facilities will also be greater under this alternative.

Impacts to the social well being of special interest groups such as community business people, ranchers, and farmers would also be more widespread under this alternative.

As the population of the area as a whole grows, spillover effects of overcrowding, traffic, and service strain will also occur in regional trade and service centers throughout the area which could ultimately affect the well being of a greater number of people.

Impacts to the social well being of members of the Fort Berthold Indian Reservation would be similar to those forecast under Alternative 2.

Alternative 4

Impacts to most communities in North Dakota will be similar to those forecasted under Alternative 3 with the exception of Dickinson and Belfield in Stark County. Under Alternative 4, Belfield is due to receive very significant population increases. The magnitude and rapidity of the population influx will produce major disruptions in the social organization and social well being of this community. Dickinson is also expected to receive moderate population impacts under this alternative although the community's experience with sizeable oil and gas transient populations in the past, the large baseline population, and the economic and social diversity of the community will help to ease many of the impacts to local social organization and social well being.

In Montana social impacts to most communities will also be very similar with respect to Alternative 3 with the exception of Dawson County. Glendive will see a much lower peak construction work force during the period 1988-93 than it would in Alternative 3. Similar reductions in the population influxes scheduled for Bloomfield and Richey, Montana, would mean less intense impacts to social organization and social well being in these communities under Alternative 4.

Social Organization

For the majority of the communities due to receive population increases under Alternative 4, the impacts to social organization will be similar to those projected under Alternative 3. However, the communities of Dickinson and Belfield in Stark County will experience more significant social impacts due to major population influxes while the communities of Glendive, Bloomfield, and Richey will undergo less dramatic growth than that projected under Alternative 3.

In terms of impacts to social organization, both Dickinson and Belfield would be subjected to some level of disruption in their social environment, especially during the two peak construction periods. Generally, impacts to social organizations these communities will experience will be similar to those outlined for other affected communities in preceding alternatives. Because Dickinson is a relatively large population center with some degree of economic and social diversity and prior experience with development-related growth, the city should

be in a fairly solid position to manage some of the social impacts it will experience. The major effect implementation of this alternative would have on the city of Dickinson would be an acceleration of the trend toward urbanization which has already begun. Belfield, on the other hand, is a smaller rural community which has only recently seen a reversal of declining population rates due to oil and gas activity in the Williston Basin. Because the rate of growth scheduled for this community will be very rapid and of a significant magnitude, impacts to the town's social organization will be major ones. Personal interaction, business dealings, and social service transactions will all likely become more formalized and official.

Although stability should be re-established in the county after construction work forces have left, the community of Belfield particularly would, like other more rural areas affected, have undergone long-term, significant social and cultural changes.

In Glendive, Montana, impacts to the community's social organization would be similar to those forecasted under Alternative 3 although the intensity of the impacts would be decreased in the initial stages of development. Because the major difference between Alternative 3 and 4 is a drop in the size of the initial peak construction work force, the community's ability to respond to growth should be more secure than it would be with Alternative 3 growth assuming the community has the fiscal resources and local cooperation needed to respond to the growth. In Richey and Bloomfield, Montana, the overall level of growth in both the short and long terms will be reduced from preceding alternatives meaning that the transition to a more complex and diverse social environment would be more gradual and possibly less traumatic for longtime residents of these communities.

Social Well Being

Impacts to the social well being of all communities affected by this alternative would be similarly significant although in the communities of Dickinson and Belfield the intensity of the impacts will be greater under Alternative 4 than they were under Alternative 3 (see Table 3-32). In Dawson County, Montana, on the other hand, it is possible that the impacts to social well being will be slightly less intense than those projected under Alternative 3 due to the overall decrease in numbers of incoming workers.

As in preceding alternatives, many impacts to social well being resulting from the implementation of Alternative 4 will be short term, confined to periods of peak construction. Larger communities, such as Dickinson and Glendive, which have undergone some expansion of service levels in the recent past due to oil and gas activity, may find their ability to cope with incoming populations is aided by their prior experience. Social services, medical and mental health services, law enforcement, and schools will all be affected, as in the preceding alternatives, by growth levels projected in Alternative 4 (see Table 3-33—3-36). Opportunities for employment and income gain for some residents of the affected communities will also result. Locals who do not directly benefit from development may find their sense of personal well being lessened with the increased crowds, noise, and crime they will encounter.

Alternative 5

The impacts to all the communities in North Dakota will be similar to those forecasted under Alternative 4 including the Fort Berthold Indian Reservation.

In the communities of Circle, Bloomfield, Richey, Glendive, and Sidney, Montana, intense, substantial, and permanent changes will occur under Alternative 5, changes that are significantly greater than those forecasted under Alternative 4. In addition to an increase in the magnitude of growth, the rapidity with which growth occurs is also increased under this alternative.

Impacts to social organization will be particular acute in the smaller communities of Circle, Richey, and Bloomfield while impacts to social well being will be significant in all the affected communities.

Social Organization

No major change in the impacts to communities in North Dakota or to the Fort Berthold Indian Reservation are expected. Those communities projected to receive a large population influx under previous alternatives will experience similar population-related impacts.

The affected Montana communities will also experience impacts to social organization similar to those forecasted under Alternative 4 with the exception of Bloomfield, Richey, Glendive, Circle, and Sidney. The major difference between the impacts from Alternatives 4 and 5 will be one of degree. While all communities will receive major increases in population under this alternative, in Glendive and Bloomfield the rate of growth will be greatly accelerated especially in the periods 1988-90. One of the most significant effects of this accelerated growth will be the increased pressure on local leaders to quickly and decisively coordinate response and mobilize resources in their communities to deal with this growth. With more intensive growth in a shorter time span, the complexity of the issues with which these communities will have to deal will also increase, perhaps requiring the hiring of city planners or administrators in communities where there presently are none. Revenues will be tighter in the initial stages of development, and local voters may be subjected to increased tax rates to help pay for needed improvements. If talk of tax increases surfaced, those who would be least likely to benefit, such as those on fixed

incomes and agricultural producers, might refuse to support the increases. Conflict between the newcomers and established community members could ensue.

Problems with the integration of newcomers will increase with the magnitude and rate of population growth. The greater the number of transients entering these communities to work at the coal mines and facilities, the harder it will be for the smaller communities to absorb them easily. The rapid change in social and cultural diversity, the rapid increase in traffic, crowds, noise and other stresses, and the chaotic appearance of the communities will likely be perceived as negative impacts by those people who always felt the slow paced, friendly, and predictable atmosphere of these communities were their major attributes.

Social Well Being

Impacts to social well being in most communities will be similar in nature and degree to those forecasted in the preceding alternatives. In the case of Glendive, Bloomfield, Richey, Circle, and to an extent, Sidney, Montana, the impacts resulting from this alternative will show a change in degree from the preceding alternatives (see Table 3-32). Because the population is expected to enter these communities in greater numbers and with much greater speed, service and facility strains will be more pronounced in the short term, and the ability of services to respond will be further reduced. The rapid nature of growth will also decrease the quality and range of services which can be offered, and if the provision of services is acutely decreased, a lowered perception of quality of life will result for the newcomers and especially for the established residents of these communities. Conflicts regarding the adequacy of present service structures may also arise especially in areas where the newcomers are not well integrated into the society. Access to and distribution of resources will be more uneven under this alternative, as the peak construction phases occur. Police, medical, educational, recreational, and all other services may experience periods of severe strain and inadequacy. With the increased rate of growth, more crime and other deviant behavior will be evident which could cause a further decrease in the sense of personal safety and well being of many longtime residents from levels anticipated under the preceding alternatives.

Alternative 6

In many communities social impacts occurring will be similar to those forecasted under Alternative 5. The exceptions are the communities of Beach and Sentinel Butte in North Dakota and Bloomfield, Circle, Glendive, Wibaux, Sidney, Savage, and Terry in Montana.

In Bloomfield, Montana, the population influx under this alternative would be significantly less than that projected under Alternative 5 (see Table 3-32). The drop in the number of immigrants would result in a more moderate level of impacts to the social organization and well being than under preceding alternatives.

In Sidney, Savage, and Terry moderately higher population influxes will result in some increase in the intensity of impacts to the social organization and social well being of these communities, an increase which, by its nature, would be hard to quantify.

In Beach, Sentinel Butte, Circle, Glendive, and Wibaux, however, very significant and rapid increases in expected population levels would, if they occurred, dramatically overwhelm the present social environments and quickly saturate the existing service and facility capacity in all communities (see Table 3-33—3-36). This rate and magnitude of growth would also create major problems for local administrators and community leaders as they attempted to deal with the changes. Without some intervention on the part of the state or federal governments or on the part of the companies involved, it is unlikely that growth of this magnitude could even be accommodated.

Because this is considered to be the maximum leasing alternative with the greatest number of communities receiving major levels of population growth, regional services and facilities would also be hardest hit under this alternative.

A reverse sequence of social impacts would be expected with the drop-off in major peak construction work forces to operational phase employment levels. If the communities manage to prepare for the highest population levels forecasted under this alternative, it is very likely that the eventual outmigration of workers, along with their contribution to the tax base, would create major "bust" effects in all communities.

Woodson PRLA

Conditions forecasted under Alternative 3 would diminish the importance of changes caused by leasing of the Woodson PRLA since most of the social changes in affected communities would be occurring even without leasing of the PRLA. The population influx attributed to the Woodson tract would slightly increase the intensity of social impacts to the communities of Glendive, Sidney, Savage, and Richey and aggravate temporary strains on community services and facilities. The introduction of additional temporary, unfamiliar populations into these communities would also add to the disruption of the patterns of community activity and could cause a slightly higher incidence of crime and other problem behaviors which could further threaten the residents' perception of community well being.

Meridian Exchange Proposal

Impacts to social organization and community well

being would vary under the different exchange segments depending on changes in population influx. Because some area residents oppose any change on ethical and legal grounds, a significant impact to their sense of personal and community well being would likely occur regardless of which proposal was adopted.

Under the initial Meridian exchange proposal, a net reduction in peak construction work forces from that anticipated under baseline in the communities of Circle, Richey, and Jordan would result in a slight decrease in anticipated short term impacts to community services and facilities and possibly a drop in the incidence of crime and other stress-related behaviors from Alternative 3 levels.

With the full Meridian gas plant or the leasing of the federal tract only the lack of any net change in population levels from Alternative 3 would mean that impacts to social organization, services, facilities, and community well being in affected communities would be similar to those forecasted under Alternative 3.

With the construction of two gas plants on both the Meridian and federal tracts, a significant increase in population influxes into Circle, Glendive, Richey, and Jordan would cause an attendant increase in the intensity of social impacts from Alternative 3 levels. The more rapid peak/decline of temporary construction work forces in all communities would put added strains on community services and facilities, would likely increase the incidence of crime and other problem behaviors, and would further accelerate the loss of the personal, informal, small town atmosphere of these communities. The introduction of two gas plants into the immediate area would also heighten concern over the issues of air and water quality both on and off-site.

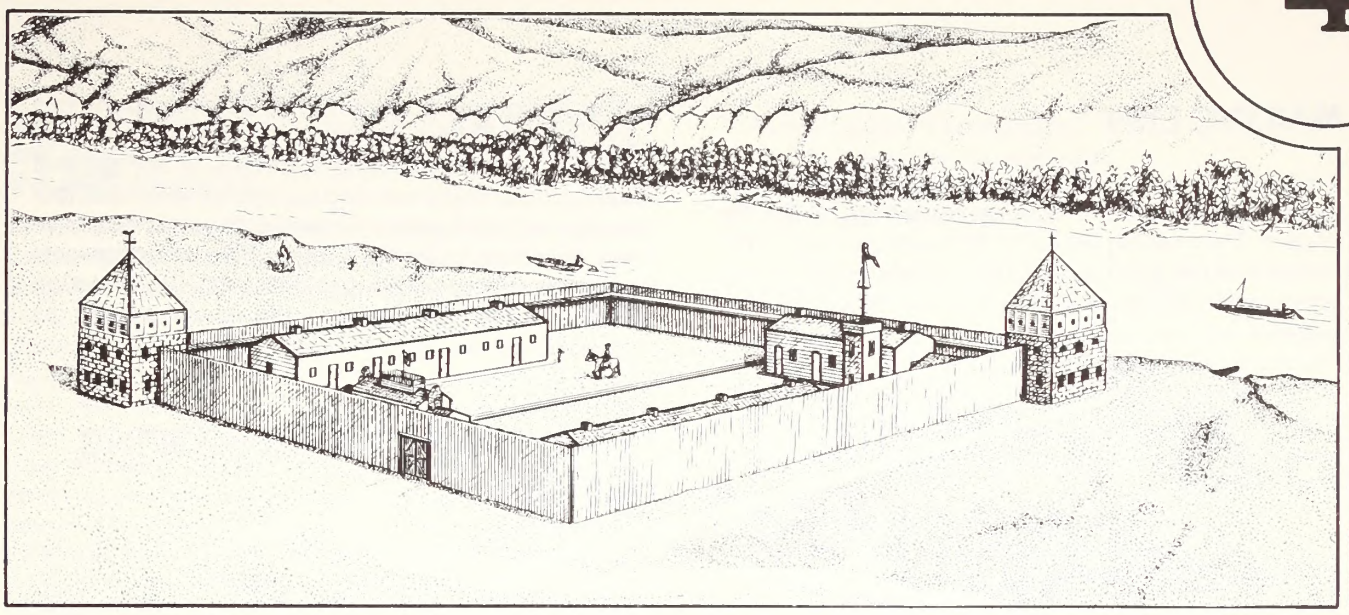
Under any of the exchange scenarios, a portion of the residents of affected communities would likely experience a substantial threat to their sense of personal and community well being; it is expressed that the exchange is not in the public interest, has not allowed for adequate levels of public input, and ultimately may threaten the rights of surface owners both on or adjacent to the tracts in question. The potential for community conflict and stress between groups opposing and favoring an exchange would thus be heightened in the area, likely into the long-term, if the proposed exchange takes place.

Summary

By-pass or maintenance leasing under Alternative 1 development would cause no immediate or substantial impacts to the social organization or well being of affected communities, other than to promote a continuation in the present level of demand for services and facilities.

Under the remaining alternatives, social impacts affecting the residents of local communities in the Fort Union Region would be closely tied to the level of population growth caused by coal leasing and development in the area. The majority of communities due to receive moderate to heavy population growth would experience some level of short term strain on community services and facilities and/or a need to build new ones. Education, law enforcement, medical services, etc., could all be severely impacted in the short term. Permanent loss of the social and cultural character of more rural areas would likely result, with the number of communities so affected varying by alternative. Concern with impacts to agricultural producers, both on and off-site, would also be expected to heighten. An increase in local job opportunities and income and the expansion of public and private facilities and services would provide positive impacts for those who are able to benefit from them. These social impacts would become progressively more intense and widespread as the level of development and estimated population influxes increased from Alternatives 2 through 6.

CHAPTER 4



CONSULTATION AND COORDINATION

In August 1980, the Regional Coal Team approved an extensive public involvement plan in conjunction with the Fort Union coal project. The plan covered both required and discretionary steps to insure widespread public awareness and involvement throughout the planning steps leading up to the 1983 federal lease sale. Some of the major steps taken include the following.

EXPRESSIONS OF LEASING INTEREST

Eighteen companies returned 36 Expressions of Leasing Interest for 15 coal deposits identified as acceptable for further leasing consideration in the three MFP areas. Including other considerations, the Expressions of Leasing Interest resulted in the 24 tracts that are being analyzed for possible leasing. Table 1-1 identified the 24 tracts as well as the companies that expressed interest in the area. Two of the companies expressing interest do not show up on Table 1-1. One company requested sub-bituminous coal of which there was none in the areas acceptable for further consideration. A second company's expression was so vague that quality and quantities of coal and locations could not be tied down.

CONTACT WITH SURFACE OWNERS

All owners of property over federal coal reserves within the region were contacted to determine whether or not they had already consented to coal development on their property through written agreement with a private company, or whether they wished to formally refuse to allow mining under their property under the provisions of the Surface Mining Control and Reclamation Act of 1977. Approximately 240 refusal to consents have been received to date. Federal coal covered by refusals to consent is being dropped from further consideration for leasing.

INFORMATION BROCHURES

Once specific areas were identified for detailed evaluation, several thousand informational brochures were distributed throughout the region. These "Facts and Issues" brochures explained what planning for the proposed coal sale was all about, and suggested how concerned individuals and groups could become involved and make their concerns known. In addition the brochures provided a public response form to identify issues felt to be worthy of careful consideration in the upcoming study. A summary of the issues identified was covered in a project newsletter, and the results are incorporated and the issues reflected in the introduction to this EIS.

MAILING LIST

An early effort was made to identify all concerned groups and citizens to develop a mailing list for the project. The mailing list currently contains over 1,000 entries and has been updated twice. Requests for those interested in being on the list were solicited in Federal Register notices, news releases, the "Facts and Issues" brochure, at Regional Coal Team meetings, and in other general contacts. The mailing list is principally used to provide current information about the Fort Union project in the form of newsletters, brochures, and news releases.

NEWSLETTER

At the direction of the coal team, a project newsletter was instituted as the mechanism to inform people at key stages in the lease sale planning. Over 1,000 of these newsletters are distributed through the mailing list. To date, there have been six newsletters issued at key stages in the project.

INFORMATIONAL MEETINGS

During April and May of 1981, six informational meetings were held throughout the region. These meetings were announced in the Federal Register, project newsletter, and through paid notices in newspapers throughout the region. The purpose of the meetings was to explain in some detail what planning for the coal sale consisted of, to answer questions, and to generally get the public involved. At the conclusion of the Miles City and Dickinson meetings, formal hearings were held to solicit testimony to help the Regional Coal Team in arriving at a recommendation to the Secretary of the Interior on the setting of a preliminary leasing target for the region. Transcripts of these hearings are publicly available, and the general results were summarized in an edition of the project newsletter.

PUBLIC REVIEW OF SITE SPECIFIC ANALYSES

Widespread public review of site specific tract evaluations is not a required part of the federal coal program. Since much of the regional analysis reflected in this draft EIS is built upon these specific evaluations, the regional coal team felt that public scrutiny of these documents was extremely important. As a result, these 24 tract evaluations were placed in libraries and other generally available areas throughout the region. They were distributed free of charge on a first-come-first-served basis, and a reprint of all 24 evaluations has been accomplished to meet an unusually heavy demand. A public oriented summary of the general findings in the SSAs was also printed for wider distribution, and several thousand copies of the summary have been distributed. Careful review of these documents has led to numerous changes in the actual information being used by the project staff in completing its regional analysis.

LEASING TARGET/EIS SCOPING HEARING

During September and October of 1980, eight public meetings were held within the region to accomplish several objectives. They were designed to solicit public comment on the site specific evaluations, identify issues for further evaluation in the regional EIS, and solicit formal testimony on the preliminary leasing target set earlier by the Assistant Secretary of the Interior. In addition to the general meetings at the eight locations, formal testimony with a hearings examiner was solicited at Glendive, Montana, and Dickinson, North Dakota.

Altogether, 70 respondents commented during this scoping-hearings period, with the transcript of comments compiled in a report to the Regional Coal Team and Interior Secretary. Of the above 70 responses, 23 constituted testimony presented at the two hearings. Those commenting included a cross-section of local organizations (Badlands Environmental Association, Dakota Resources Council), national organizations (Sierra Club), local government (Richland County (MT) Planning Board, Dickinson (ND) Board of City Commissioners), other agencies (U.S. Fish and Wildlife Service), Industry (Tenneco Coal Company, Nokota Company), and private individuals. Those responses dealt with a review of the site specific reports, as well as EIS issues/scope and the federal leasing target.

In addition to the formal comments above, some 50 issues were listed on flip charts and assigned to project staff to address. General categories of issues are discussed in the EIS introduction section.

WORK GROUPS

General work groups were established early in the project to provide guidance and review to the work done on the site specific analyses. These work groups consisted of specialists from a variety of federal and state agencies, local officials, and private citizens with special expertise or concern with coal development. These work groups played a major role in the development of the standards and framework through which the site

specific evaluations were done as well as the context and issues within which the project staff has prepared this draft regional EIS.

In addition to the above steps to insure public awareness and involvement, eight meetings of the Fort Union Regional Coal Team have been held and opportunity for public comment before that body made available throughout these meetings. Minutes of the Regional Coal Team meetings have been distributed to all those who requested them. General media coverage has been extensive throughout key stages of the federal coal planning process, and issues have surfaced at every stage in the process. A summary of those general issues, which provided the focus for the analysis in this draft EIS, is covered in the introduction to the draft.

Both in general meetings and contacts at the Regional Coal Team and project management level, as well as the conduct of specific analyses reflected in the SSAs and the draft EIS, numerous contacts have been made with a wide variety of groups and individuals. The following is a listing which, while not comprehensive, typifies the contacts made in preparing this EIS.

Federal Agencies

Department of Agriculture
- Agricultural Stabilization and Conservation Service
- Economic Research Unit
- Forest Service
- Science and Education Administration
- Soil Conservation Service

Department of the Interior
- Bureau of Indian Affairs
- Bureau of Mines
- Bureau of Reclamation
- Fish and Wildlife Service
- Geological Survey
- Minerals Management Service
- National Park Service
- Office of Surface Mining
- Environmental Protection Agency

State Agencies

Montana
- Department of Fish, Wildlife and Parks
- Department of Health and Environmental Sciences
- Department of Natural Resources and Conservation
- Department of State Lands
- State Historic Preservation Officer

North Dakota
- Department of Health
- Geological Survey
- Livestock Sanitary Board
- Public Service Commission
- Soil Conservation Commission
- State Historic Preservation Officer
- Water Commissioner

County/Regional Planning Groups

Montana
- Dawson County Planning Department
- Dawson County Public Welfare Department
- McCone Agricultural Services Administration
- Richland County Planning Department

North Dakota
- Badlands Human Services Center
- Beulah Community Planning Department
- Dickinson City Administration/Planner
- Golden Valley County Public Welfare Department
- Hazen Community Planning Department
- Lewis and Clark 1805 Regional Council for Development
- Mercer County Social Services Department
- Roosevelt-Custer Regional Council for Development

Educational Institutions

Montana State University, Reclamation Research Unit
University of Montana, Department of Athropology
North Dakota State University, Reclamation Research Unit
University of North Dakota, Department of Anthropology and Archaeology

DRAFT EIS MAILING

All of those agencies listed below have been sent copies of the draft EIS for official review and comment. All groups and individuals on the Fort Union mailing list have also received a copy of the draft EIS for public review and comment. Additional copies will also be made available upon request.

Federal Agencies

Department of Agriculture
- Forest Service
- Soil Conservation Service

Department of the Army, Corps of Engineers
Department of Energy
Department of the Interior
- Bureau of Indian Affairs
- Bureau of Reclamation
- Fish and Wildlife Service
- Geological Survey
- Minerals Management Service
- National Park Service
- Office of Surface Mining

Department of Justice
Department of Transportation
Environmental Protection Agency

Indian Tribes

Crow Indian Reservation
Fort Berthold Indian Reservation
Fort Peck Indian Reservation
Northern Cheyenne Indian Reservation
Standing Rock Indian Reservation

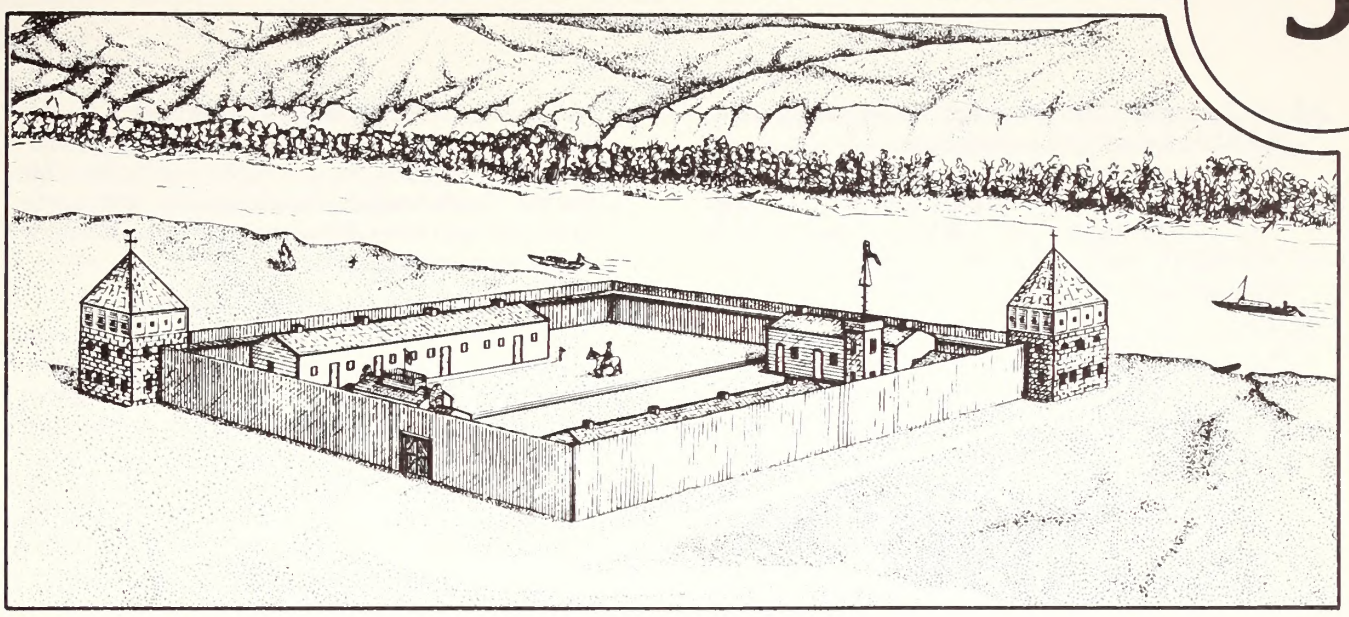
State Agencies

Montana State Clearinghouse
North Dakota Clearinghouse

Local Agencies

Dawson County Commissioners
McCone County Commissioners
Richland County Commissioners
Wibaux County Commissioners
Dunn County Commissioners
Golden Valley County Commissioners
McLean County Commissioners
Mercer County Commissioners
Oliver County Commissioners
Stark County Commissioners

CHAPTER 5



LIST OF PREPARERS

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The following individuals under ECOS Management Criteria, Inc., provided the material for the Air Quality contract for the Ft. Union EIS:

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Michael Machler: Air Quality Meteorologist
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Deborah Rykaczewski: Environmental Meteorologist
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Khanh T. Tran: Air Quality Modeling Specialist
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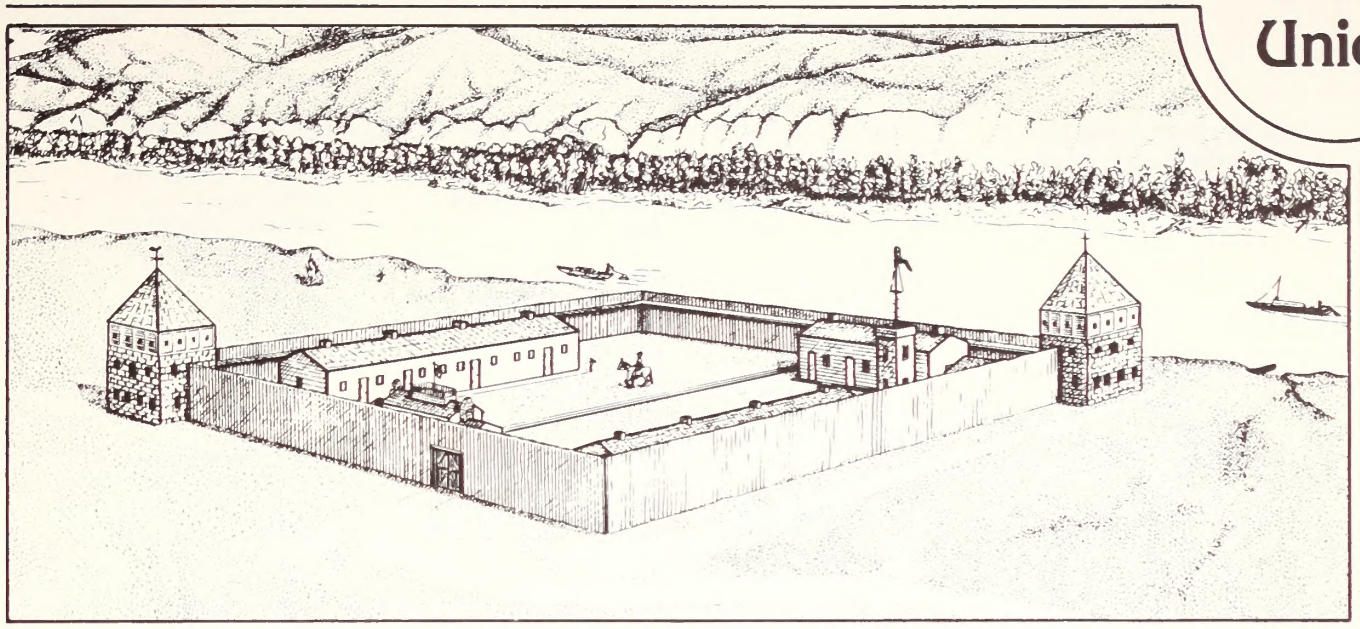
Richard L. Webb, Jr.: Air Quality Analyst
JD Environmental Law, Georgetown University. Seven years experience as law clerk and attorney in environmental law with law firms, currently a consultant in environmental law with GeoResearch, Inc. Prepared the regulatory portion of the EIS air quality study.

APPENDICES

Fort Union



APPENDIX A

FEDERAL LAWS AFFECTING COAL DEVELOPMENT AND ENERGY CONVERSION

Popular Name	Public Law/U.S. Code Citation	Purpose	Major Relevance
Antiquities Act of 1906	59-209; 16 U.S.C. 431	Regulates antiquities excavation and collection (including fossil remains).	Mitigates potential harm to historical, archaeological, and paleontological resources.
		Protects historical values on public land.	
Archaeological and Historical Preservation Act of 1974; Archaeological Salvage Act	93-291, 86-523; 16 U.S.C.469	Provides for recovery of data from areas to be affected by federal actions.	Mitigates potential harm to historical, archaeological, and paleontological resources.
		Provides for preservation of data (including relics and specimens) at every federal construction project.	Mitigates potential harm to historical and archaeological resources.
Bald Eagle Protection Act of 1969, as amended	86-70; 16 U.S.C. 668	Protects bald and golden eagles.	May make certain coal lands off-limits for development.
Clean Air Act Amendments of 1977	95-95; 42 U.S.C. 7401	Establishes requirements for areas failing to attain National Ambient Area Quality Standards (NAAQS).	May make certain coal lands off-limits for development.
		Provides for prevention of significant deterioration of areas where air is cleaner than NAAQS.	Limits industrial development within and adjacent to areas exceeding NAAQS and areas preserving clean air quality.

Clean Air Act Amendments of 1977 (Cont.)		May require a federal permit where conflicts with coal development exist.	Reduces commercial attractiveness of low-sulfur Western coal as the new source standard changed to percent emmissions reduction.
		Modifies 1970 air act provisions regarding federal facilities, enforcement strategies, coal utilization impacts, and interstate air pollution.	
Clean Water Act of 1977	95-217; 33 U.S.C. 1251	Establishes effluent limitations for new and existing industrial discharges into U.S. waters.	May reduce development options in areas where anti-degradation policy restricts discharges into high quality waters.
		Limitations set for public treatment discharges; with pretreatment by industrial users.	Treatment facilities in areas with rapidly expanding infrastructures must meet water quality standards.
		Provides mechanism to restore and maintain integrity of the nation's waters.	Effluent standards apply to coal mining point sources.
Endangered Species Act of 1973; as amended	93-205; 16 U.S.C. 1531	Protects endangered and threatened species and critical habitat from federal activities. Requires prior consultation with Fish and Wildlife Service.	May make certain coal lands unsuitable for development
Fish and Wildlife Coordination Act of 1934	85-624; 16 U.S.C. 661	Requires consultation about water resource development actions which might affect fish or associated wildlife resource.	Mitigates potential federal coal development impacts.
Historic Preservation Act of 1966	89-665; 16 U.S.C. 470. See also 94-429; 16 U.S.C. 1609	Establishes system of classifying properties on or eligible for inclusion on Historic Register.	Mitigates potential harm to historical and archaeological values.
		Mandates federal agency consultation with Advisory Council and State historic preservation officers.	
National Environmental Policy Act of 1969	91-190; 42 U.S.C. 4321	Makes environmental protection part of the mandate of every federal agency.	Provides legislative authority to control energy development on environmental grounds.
		Requires impact statements for major federal actions with potentially significant impacts.	Impact statement process must be integral part of coal leasing system.
Mining and Minerals Policy Act of 1970	91-631; 43 U.S.C. 21	Declares Congressional Minerals Policy.	Provides broad, general principles for mineral resource development.

Noise Control Act of 1972	92-574; 42 U.S.C. 4901	Requires publication of information on limits of noise required to protect public health and welfare.	Regulations may be proposed to control coal mining areas and activities.
		Preempts local control of railroad equipment and yard noise emissions.	
Resources Conservation and Recovery Act of 1976	94-580; 42 U.S.C. 6901	Establishes guidelines for collection, transport, separation, recovery, and disposal of solid waste.	Mining locations may be affected by EPA regulations governing disposal of coal mining wastes.
		Creates major federal hazardous waste regulatory program.	Coal industry faced with stringent permit requirements if coal wastes classified by EPA as hazardous.
		Provides assistance to establish state or regional solid waste plans.	
Safe Drinking Water Act of 1977	95-190; 42 U.S.C. 300	Establishes mechanism for National Primary Drinking Water Standards.	EPA conducting study of the impacts of pits, ponds, lagoons, etc. on underground water supplies for public water systems.
Soil and Water Resources Conservation Act of 1977	95-192; 16 U.S.C. 2001	Requires appraisal by Secretary of Agriculture of information and expertise on conservation and use of soils, plants, woodlands, etc.	Provides opportunity for expanded data base.
Multiple-Use Sustained Yield Act of 1960	86-519; 16 U.S.C. 528	Requires management of national forests under principles of multiple use so as to produce a sustained yield of products and services.	Mandates land management principles similar to those required under FLPMA.
National Forests Management Act of 1976	95-233; 16 U.S.C. 472a	Provides for a comprehensive system of land and resource management planning for National Forest System lands.	Key factor in the Department of the Interior's determination of where coal leasing would occur.
Department of Energy Organization Act of 1977	95-91; 42 U.S.C. 7101	Transfers authority to issue some coal regulations from DOI to DOE, including production regulations.	Limits coal management authority exercised by the Department of the Interior.
		DOE determines long-term national coal production goals.	Requires program to establish proper coordination mechanisms.
Act of September 28, 1976	94-429; 16 U.S.C. 1908	Provides for the regulations of mining activity within, and to repeal the application of mining laws to, areas of the National Park System, and for other purposes.	Requires recognition and protection of nationally significant natural areas as they relate to surface mining.

Source: Final Environmental Statement, Federal Coal Management Program, USDI, BLM, 1979.

APPENDIX B

STATE LEGISLATION

Lead State Agency	Legislation	Purpose or Relevance
Department of Natural Resources and Conservation	Montana Major Facility Siting Act	Vests in the department the authority to require and review long-range planning by certain utilities, to give approval to energy generation and conversion plant sites and associated facilities, and to require preconstruction certification of such facilities.
Environmental Quality Council	Montana Environmental Policy Act	The purpose of this act is to declare a state policy which will encourage productive and enjoyable harmony between man and his environment, to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man, to enrich the understanding of the ecological systems and natural resources important to the state, and to establish an environmental quality council.
Montana Department of Health and Environmental Sciences	Montana Water Pollution Control Law Montana Water Quality Criteria Montana Pollutant Discharge Elimination System Permit Montana Solid Waste Management Act Montana Refuse Disposal Regulations Montana Clean Air Act Montana Air Quality Regulations	All laws and regulations designed to minimize contamination and pollution and maintain the quality of the environment by establishing standards and maximum amounts of deviation of pollutant substances.
Montana Department of Highways		The Montana Department of Highways may approve or disapprove the relocation of roads and railroads across state lands or across existing highways.
Montana Department of State Lands		The Department of State Lands may grant or deny surface-mining permits.
	Montana Strip and Underground Mine Reclamation Act	The Act and promulgated rules contain detailed standards regarding the method of mining, blasting, subsidence, stabilization, water control, backfilling, grading, highwall reduction, topsoiling, and for the reclamation of lands affected by the proposed mining operations.
	Strip Mined Coal Conservation Act	The intent of the Coal Conservation Act is to prevent waste of marketable coal.
	State Antiquities Act Chapter 25 of Title 81, R.C.M. 1947	Administered by the DSL and the Board of Land Commissioners and provides for the registration and protection of historical, prehistorical, archaeological, paleontological, scientific, or cultural sites and objects on state lands.

Board of Land Commissioners	Section 81-103, R.C.M. 1947	Requires that the Board of Land Commissioners provides for the registration and protection of historical, prehistorical, archaeological, paleontological, scientific, or cultural sites and objects on state lands.
	Section 81-501, R.C.M. 1947	Authorizes the Board to grant coal leases.
North Dakota State Department of Health	North Dakota Air Pollution Control Act	Requires plans to issue permit to construct, install, modify, use, or operate any air contaminant source.
	Solid Waste Management and Land Protection Act	Required to approve or disapprove permits for solid waste disposal plans. Also enforces North Dakota New Source Performance Standards.
—Environmental Health and Engineering Services	North Dakota Water Pollution Control Act	Responsible for establishing and administering standards to prevent or abate pollution of state waters.
—Environmental Control	North Dakota Century Code (NDCC 23-25)	Provides means of presenting significant deterioration of state air quality as related to energy development. Involves review of application for permit to construct or operate facilities and monitoring of facilities after operational.
	NDCC 23-29	Requires permits for solid waste disposal facilities.
	NDCC 61-28	Responsible for establishing and administering standards to prevent or abate pollution of state waters. Requires application for and receipt of a permit to discharge mine water.
North Dakota State Water Commission	NDCC 61-04	Permit must be secured for all appropriations of water for industrial uses greater than 5000 acre-feet.
	NDCC 61-02; 61-16	Permit must be obtained with the approval of the local water management district for construction of dikes or dams for water storage greater than 12.5 acre-feet.
North Dakota State Industrial Commission · State Geologist	NDCC 38-121	Requires a permit for coal exploration and requires the filing of basic coal exploration data with the State Geologist.
North Dakota State Engineer	NDCC 61-04	Permit must be secured for all appropriations of water for industrial use less than 5000 acre-feet.
	NDCC 61-01	Permit must be obtained with the approval of the local water management district for drainage.
North Dakota Land Development	NDCC 15-05	Responsible for leasing of state coal. Also authorized to coordinate leasing activities with Federal leasing in order to prevent speculation.

North Dakota Highway Commission	NDCC 24-01	Authorized to approve or disapprove granting rights-of-way for communication or power lines, pipelines, etc., along or over state highways. Also controls placement of railroad lines affecting state highways.
North Dakota Industrial Commission		Requires permits for drilling for purposes of coal exploration.
North Dakota Public Services Commission	North Dakota Surface Owners Protection Act NDCC Chapter 38-18	Requires approval of surface owners prior to permitting of mining plans. Issues permits for surface mining activities.
	NDCC 38-14	Requires application for and receipt of a permit for coal surface mining and reclamation activities.
	NDCC 49-22	Regulates siting of conversion and transmission facilities through the North Dakota Facility Siting Act. Requires the application for and receipt of: 1. certificate of site compatibility, 2. certificate of corridor compatibility, and 3. route permit for transmission facility within corridor.
North Dakota Energy Development Impact Office	NDCC 57-62	Authorized to issue state funds to aid areas experiencing impacts due to coal development. Authorized to issue financial grants to impacted taxing districts which demonstrate extraordinary expenditures caused by coal development and the growth incidental thereto.

APPENDIX C

IMPORTANT POLLUTANTS IN THE FORT UNION REGION

Total Suspended Particulates (TSP) include all solid or semi-solid material found in the atmosphere. It includes all kinds of dust and smoke originating from both natural and man-made sources such as agricultural activities, automobile exhaust, power plant emissions, road sand, wind-blown dust, and coal development and mining. The health implications of TSP are the most complex and least understood of all common pollutants since the particulate mixture contains many chemical species and a variety of sizes. The main health concern is that particles in the respirable size range can be inhaled and trapped in the lungs. The chemical nature of the particulates then becomes important in terms of health effects on the lungs and the rest of the body. Less serious to health but of considerable aesthetic as well as economic importance is the fact that particulates reduce clarity and visibility in the atmosphere.

Sulfur Dioxide (SO_2) is a colorless, pungent, irritating gas that most people can detect by smell or taste at low levels. It is emitted mainly from stationary sources that utilize fossil fuels (coal, oil, gas) such as power plants, gas sweetening plants, and oil well flares and vents. The pollutant is known to cause a loss in crop yield, rusting of metals, reduction of visibility, and irritation of eyes, nose, throat, and lungs.

Ozone (O_3) is a highly reactive, unstable gas that also has a characteristically pungent odor most commonly identified with lightning storms or other electrical discharges. Increased levels of man-made ozone occur as a result of hydrocarbon and nitrogen oxides emissions, primarily from the combustion of fossil fuels. Hydrocarbons react with nitrogen oxides under the influence of sunlight to form ozone. This strong oxidizing agent causes wide-spread material damage and has been documented as a potential health hazard.

Typically, the highest concentrations of ozone are found 20 to 50 miles downwind of the hydrocarbon sources due to the time required for its formation.

Nitrogen Dioxide (NO_2) is a reddish-orange-brown gas with a characteristically pungent odor. It is corrosive and a strong oxidizing agent. Nitrogen dioxide and nitric oxide (NO) are the two principal oxides of nitrogen that are formed during high temperature combustion when nitrogen and oxygen are present. In the atmosphere these two oxides of nitrogen are closely involved in the photochemical oxidants.

Carbon Monoxide (CO) is a tasteless, colorless, odorless gas in the earth's atmosphere. It occurs naturally in the air as the result of forest fires, the oxidation of methane, and other natural processes. Natural background levels, however, are insignificant compared to man-made concentrations produced primarily by automobiles. The health concern for CO centers around complications that arise when CO reacts with the hemoglobin in red blood cells. The substance formed reduces the amount of oxygen delivered to the body, increases the clotting tendency of the blood, and enhances edema formation.

Hydrogen Sulfide (H_2S) is a highly malodorous gas with the odor of rotten eggs. It occurs naturally in natural gas, particularly in so-called sour gas such as found in many gas wells in the Fort Union Coal Region. Man-made sources include sewage treatment, paper processing, and oil refining. The pollutant can damage paint, tarnish copper, injure vegetation, produce a loss of the sense of smell, cause severe respiratory tract irritation, and in large doses, cause death.

Lead (Pb) is a gray-blue metal. Atmospheric lead emissions generally result from ore smelters and the combustion of gasoline that contains tetraethyl lead as an anti-knock compound. Human exposure can be through inhalation or ingestion of particulates containing lead. The health implications of lead include impairment of hemoglobin production, anemia, and limited cases of encephalopathy and/or death.

Trace elements, such as the heavy metals, are found generally throughout the natural environment, usually in very minute or "trace" concentrations. There is no significant existing problem with trace element air pollutants in the Fort Union Coal Region, but extensive development of coal reserves could lead to their enrichment in the soil, through deposition of coal combustion emissions, with subsequent possible effects upon vegetation, animals, or both. These effects could be either direct or via the food chain.

APPENDIX D

POINT SOURCE PARTICULATE EMISSION ESTIMATES FOR 1980

Sources Within the Montana Portion of Fort Union Coal Region

Source	County	City	Part. Tons/Year
Montana Dakota Utilities	Richland	Sidney	132
Knife River Coal	Richland	Savage	150*
Holly Sugar	Richland	Sidney	389

Sources Near the Montana Portion of Fort Union Coal Region

Source	County	City	Part. Tons/Year
West Decker Coal	Bighorn	Decker	2,136*
East Decker Coal	Bighorn	Decker	1,995*
Spring Creek Coal	Bighorn	Hardin	2,001*
Westmoreland Resources	Bighorn	Hardin	1,180*
Montana Power (Corrette)	Yellowstone	Billings	989
Continental Oil Co.	Yellowstone	Billings	249
Exxon Co. USA	Yellowstone	Billings	612
Great Western Sugar	Yellowstone	Billings	114
Bighorn Calcium	Bighorn	Warren	240*
Western Energy	Rosebud	Colstrip	4,796*
Peabody Coal	Rosebud	Colstrip	1,164*
Montana Power Co. 1 & 2	Rosebud	Colstrip	887
Northern Cheyenne Forest Prod.	Rosebud	Ashland	140*

Source: Montana State Air Quality Bureau 1981

*Fugitive emissions associated with mining and vehicle traffic are included.

SULFUR DIOXIDE EMISSION ESTIMATES FOR 1980

Sources Within the Montana Portion of Fort Union Coal Region

Source	County	City	SO_2 Tons/Year
Montana Dakota Utilities	Richland	Sidney	2,192
Shell Oil, gas plant	Richland	Sidney	1,278
Perry Petrolane, gas plant	Richland	Sidney	867
Valley County Ind. Park	Valley	Glasgow	174
KENCO	Roosevelt	Wolf Point	

Sources Near the Montana Portion of Fort Union Coal Region

Source	County	City	SO_2 Tons/Year
Exxon Co., USA	Yellowstone	Billings	10,735
Farmer's Union CENEX	Yellowstone	Laurel	10,380
Montana Power Co. (Corrette)	Yellowstone	Billings	9,811
Continental Oil Co.	Yellowstone	Billings	3,051
Montana Sulfur	Yellowstone	Billings	2,136
Great Western Sugar	Yellowstone	Billings	711
Westmoreland Resources	Big Horn	Hardin	57*
East Decker Coal	Big Horn	Decker	46*
West Decker Coal	Big Horn	Decker	46*
Spring Creek Coal	Big Horn	Hardin	17*
American Colloid	Phillips	Malta	63
Western Energy Coal	Rosebud	Colstrip	46*
Peabody Coal	Rosebud	Colstrip	17*

Source: Montana State Air Quality Bureau 1981.

*Includes tailpipe emissions from diesel powered vehicles.

ESTIMATED EMISSIONS
MAJOR STATIONARY EMISSION SOURCES
WESTERN NORTH DAKOTA

Major Natural Gas Processing Plants

Name & County	Cap. mcf/d	Start-up	Products	SO_2 (t/yr)	NO_x (t/yr)	Part. (t/yr)	H.C. (t/yr)
Tioga Plant Aminoil Williams Co.	67 22[1]	1954	1. Natural gas 2. Sulfur (67)	3,732	1,920	26	737
Little Knife Warren Pot. McKenzie Co.	15 20[1]	1978	1. Natural gas	1,085	7		
Lignite Plant Cities Service Burke Co.	6	1962	1. Natural gas	2,400			
Red Wing Co. True Oil McKenzie Co.	3.5	1975		.1	177	2	64
Boxcar Butte Kerr McGee Corp. McKenzie Co.	6 2[1]	1976	1. Natural gas	135.4	39	4	53
Cherry Creek Alpar Res. Williams	3-5	1979	1. Natural gas	469			
T.R. Western Gas Billings Co.	15.2	1980	1. Natural gas	990	16.5	10	.3
Missouri Ridge Tenneco Oil Williams Co.	2	1979	1. Natural gas	.0012	.46	.03	.006
Kock McKenzie Co.	30	1980	1. Natural gas	902	.4	2	23
Subtotal				9,713.5	2,160.4	44	877.4

Proposed Plants

Name & County	Cap. mcf/d	Start-up	Products	SO_2 (t/yr)	NO_x (t/yr)	Part. (t/yr)	H.C. (t/yr)
Amoco Billings Co.	100	—	1. Natural gas	1,090	52	6.16	1.6
Phillips Williams Co.	27	—	1. Natural gas	410	162	—	—
Subtotal				1,500	2.4	6.16	1.6
TOTAL				11,213.5	2,588.4	50	879

[1]Proposed expansion.

Source: NDSDM

APPENDIX E

AMBIENT AIR QUALITY STANDARDS (Federal, North Dakota, Montana)

Pollutant	Federal Primary Standard	Federal Secondary Standard		North Dakota Standard	Montana Standard
Total Suspended Particulates	75 ug/m³ annual geom. mean 260 ug/m³ 24-hr. average*	6 ug/m³ annual geom. mean 150 ug/m³ 34-hr. average*		60 ug/m³ ann. geo. mean 250 ug/m³; Max. 24-hr avg.*	75 ug/m³ ann avg. 200 ug/m³ 24-hr avg.*
Settled Particulates (Dustfall)	None	None	15 tons/ sq. mile	Max. 3-month arithmetic mean in residential areas	10 gm/m³ 30-day avg.
			30 tons/ sq. mile	Max. 3-month arithmetic mean in heavy industrial areas	
Sulfur Dioxide	0.03 ppm (80 ug/m³) annual arithmetic average 0.14 ppm (365 ug/m³) 24-hour average	05 ppm (1300 ug/m³) 3-hour average	60 ug/m³ (0.02 ppm)	Max. Annual arithmetic mean	0.02 ppm ann. avg. 0.10 ppm 24-hr avg*. 0.50 ppm 1-hr avg.**
			260 ug/m³ (0.10 ppm)	Max. 24-hr. concentration	
			715 ug/m³ (0.24 ppm)	Max. 1-hr. concentration	
Reactive Sulfur	None	None	0.24 mg/100 cm²/day	Max. annual arithmetic mean	None
			0.50 mg/100 cm²/day	Max. for a 1-month period	
Suspended Sulfate	None	None	4 ug/m³ 12 ug/m³	Max. ann. arithmetic mean; Max. 24-hr concentration not to be exceeded over 1 percent of the time.	None
Sulfuric acid mist, sulfur trioxide or any combination thereof	None	None	4 ug/m³	Max. annual arithmetic mean	None
			12 ug/m³	Max. 24-hr concentration not to be exceeded over 1 percent of the time	
			30 ug/m³	Max. 1-hr concentration not to be exceeded over 1 percent of the time.	
Hydrogen Sulfide	None	None	45 ug/m³ (0.032 ppm)	Max. 1/2-hr concentration not to be exceeded more than twice in any 5 consecutive days.	0.05 ppm hourly avg.*
			75 ug/m³ (0.054 ppm)	Max. 1/2-hr concentration not to be exceeded over twice a year.	
Carbon Monoxide	9 ppm (10 mg/m³) 8-hr avg.* 35 ppm (40 mg/m³) 1-hr avg.*	9 ppm (10 mg/m³) 8-hr avg.*	10 mg/m³ (9ppm)	Max. 3-hr concentration*	9 ppm 8-hr avg.* 23 ppm hourly avg.*
			40 mg/m³ (35 ppm)	Max. 1-hr concentration*	
Nitrogen Dioxide	0.05 ppm (100 ug/m³) annual arithmetic average	0.05 (100 ug/m³) annual arithmetic average	100 ug/m³ (0.05 ppm) 200 ug/m³ (0.10 ppm)	Max. annual arithmetic mean Max. 1-hr concentration not to be exceeded over 1 percent of the time in any 3-month period	0.10 ppm hourly avg.*
Photochemical Oxidants (Ozone)	0.12 ppm (235 ug/m³) 1-hr average*	0.12 ppm (235 ug/m³) 1-hr average*	235 ug/m³ (0.12 ppm)	Max. 1-hr concentration*	0.10 ppm hourly avg.*
Hydrocarbons (Less Methane)	.24 ppm (160 ug/m³) 3-hr concentration (6-9 a.m.)*	.4 ppm (160 ug/m³) Max. 3-hr concentration (6-9 a.m.)*	160 ug/m³ (.24 ppm)	Max. 3-hr concentration (6-9 a.m.)*	None
Lead	1.5 ug/m³ calendar quarter average	None	1.5 ug/m³	quarterly arithmetic mean	1.5 ug/m³ 90-day average
Foliar Fluoride	None	None	None		35 ug/g grazing season 50 ug/g monthly average
Visibility	None	None	0.4 coh. per 100 linear ft.	Max. annual geom. mean (coefficient of haze)	Particle scattering coefficient of 3 x 10^{-5} per meter annual average***

*Not to be exceeded more than once per year.
**Not to be exceeded more than 18 times per any 12 consecutive months.
***Applies only to PSD Class I areas.

Sources:
National Ambient Air Quality Standards 1978;
North Dakota Air Pollution Regulations 1978;
Montana Air Pollution Regulations 1980.

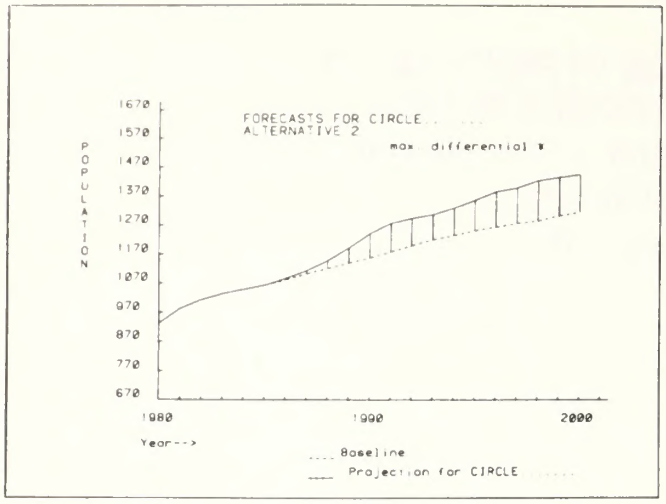
APPENDIX F

EMISSIONS OF RADIONUCLIDES IN PARTICULATE MATTER FROM A 1000 MW POWER PLANT: CONCENTRATION OF URANIUM, LEAD, AND POLONIUM IN FLY ASH ASSUMED (microcuries per day)

Coal Type	Bituminous	Bituminous	Subbituminous	Subbituminous	Bituminous
Radionuclide	Appalachia	Illinois-W. Kentucky	Powder River Basin Wyoming	Navajo Reservation New Mexico	Kaiparowits Plateau Utah
Uranium 238	66.5	150.0	63.5	87.5	48.0
Thorium 234	13.3	30.0	12.7	17.5	9.6
Protactinium 234	13.3	30.0	12.7	17.5	9.6
Uranium 234	66.5	150.0	63.5	87.5	48.0
Thorium 230	13.3	30.0	12.7	17.5	9.6
Radium 226	13.3	30.0	12.7	17.5	9.6
Radon 222	3,140.0	7,050.0	2,980.0	5,000.0	2,260.0
Polonium 218	66.5	150.0	63.5	87.5	48.0
Lead 214	66.5	150.0	63.5	87.5	48.0
Bismuth 214	13.3	30.0	12.7	17.5	9.6
Polonium 214	13.3	30.0	12.7	17.5	9.6
Lead 210	66.5	150.0	63.5	87.5	48.0
Bismuth 210	13.3	30.0	12.7	17.5	9.6
Polonium 210	66.5	150.0	63.5	87.5	48.0
Thorium 232	7.9	9.4	11.6	27.6	7.1
Radium 228	7.9	9.4	11.6	27.6	7.1
Actinium 228	7.9	9.4	11.6	27.6	7.1
Thorium 228	7.9	9.4	11.6	27.6	7.1
Radium 224	7.9	9.4	11.6	27.6	7.1
Radon 220	1,870.0	2,220.0	2,720.0	6,500.0	1,670.0
Polonium 216	7.9	9.4	11.6	27.6	7.1
Lead 212	39.5	47.0	58.0	138.0	35.5
Bismuth 212	7.9	9.4	11.6	27.6	7.1
Polonium 212	5.1	6.0	7.4	17.7	4.5
Thalluim 208	2.8	3.4	4.2	9.9	2.6
Potassium 40	30.0	47.2	10.5	33.4	11.2
Total	5,635	10,550	6,331	12,610	4,389

Source: U.S. Environmental Protection Agency - Potential Radioactive Pollutants Resulting From Expanded Energy Programs (EPA-600/7-77-082) August 1977.

APPENDIX G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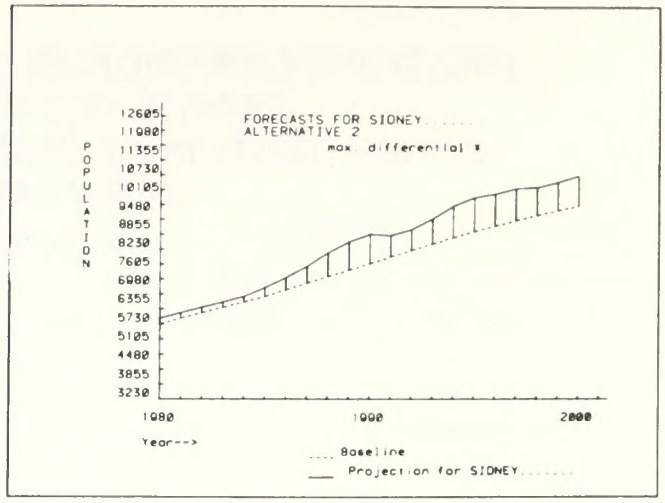
1270
1170
1070
970
870
770
670
1980
1990
2000
Year-->
Baseline
Projection for CIRCLE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1990
2000
Year-->
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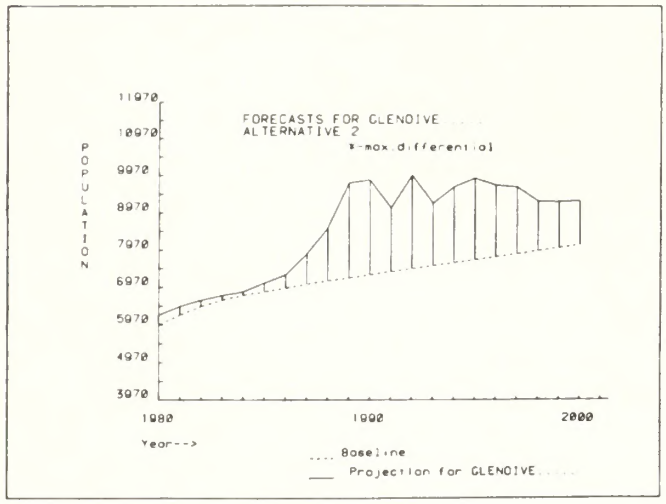
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1990
2000
Year-->
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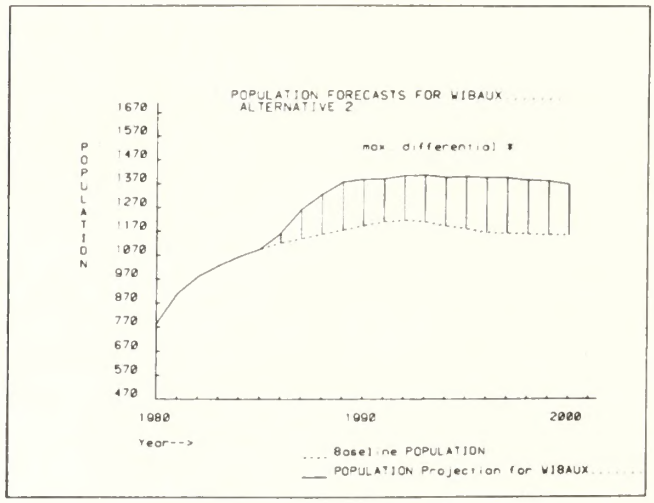
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1980
1990
2000
Year-->
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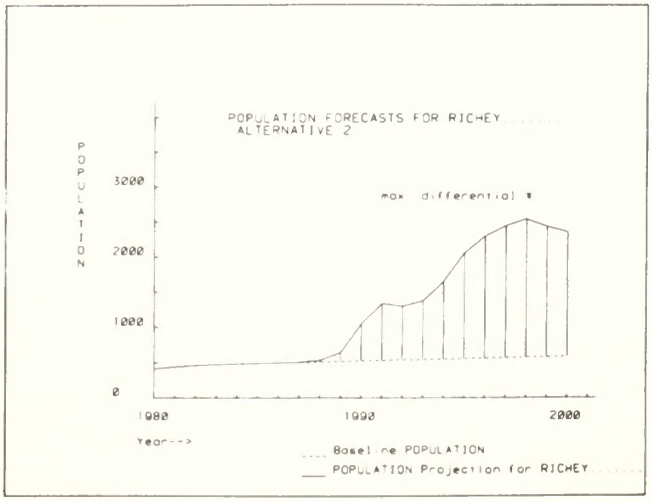
POPULATION Projection for WIBAUX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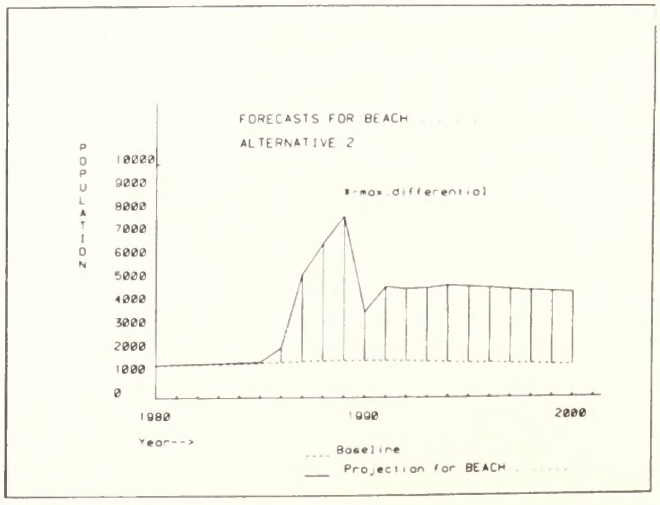
POPULATION Projection for RICHEY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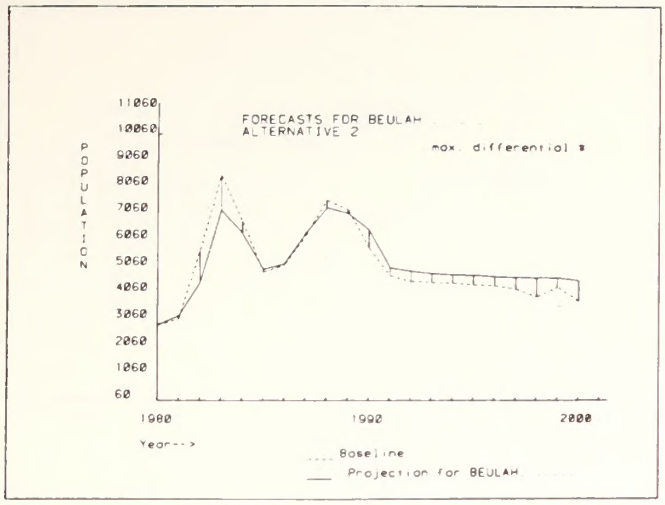
1990
2000
Year-->
Baseline
Projection for BEACH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1990
2000
Baseline
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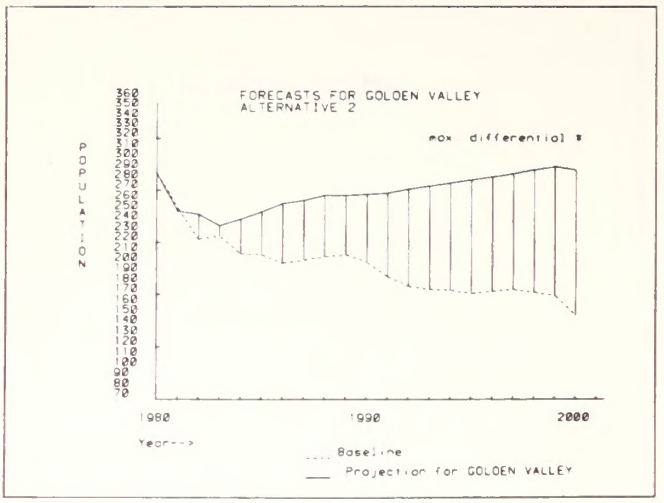
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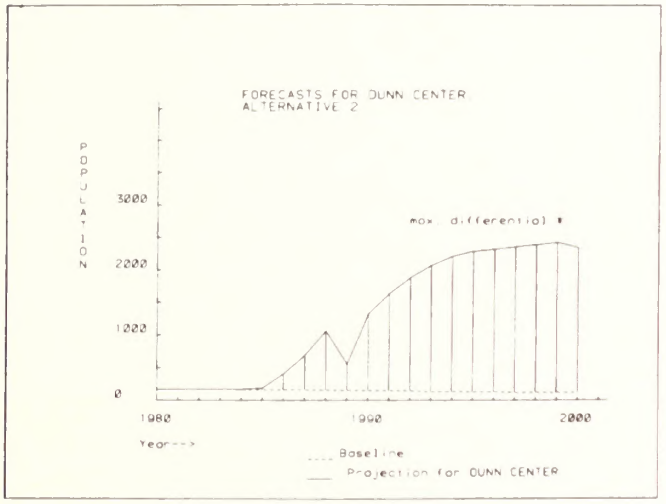
1990
2000
Baseline
Projection for GOLDEN VALLEY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1990
2000
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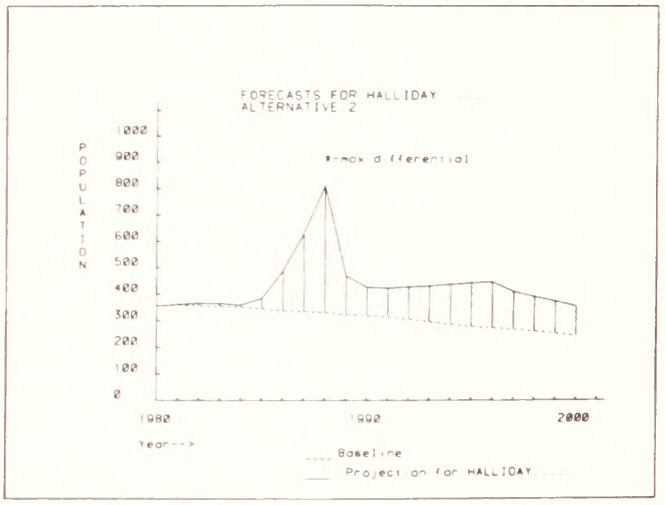
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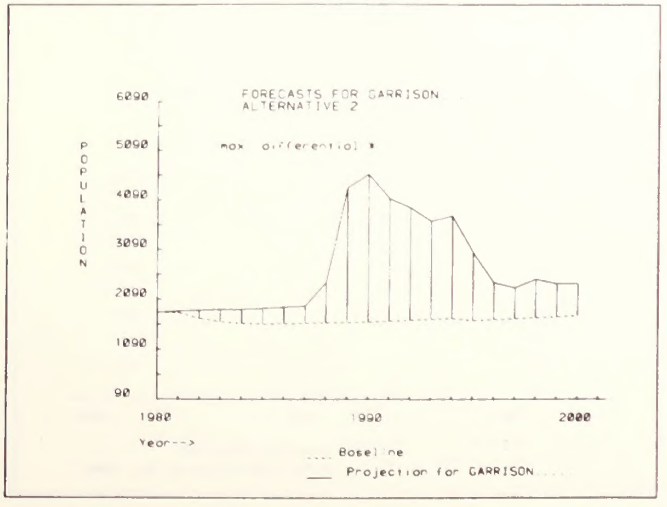
1990
2000
Baseline
Projection for HALLIDAY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Year-->
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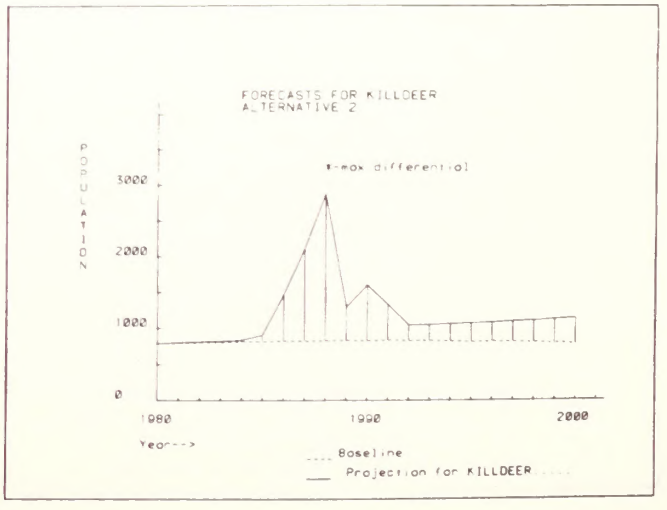
1990
2000
Baseline
Projection for GARRISON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POPULATION
Year-->
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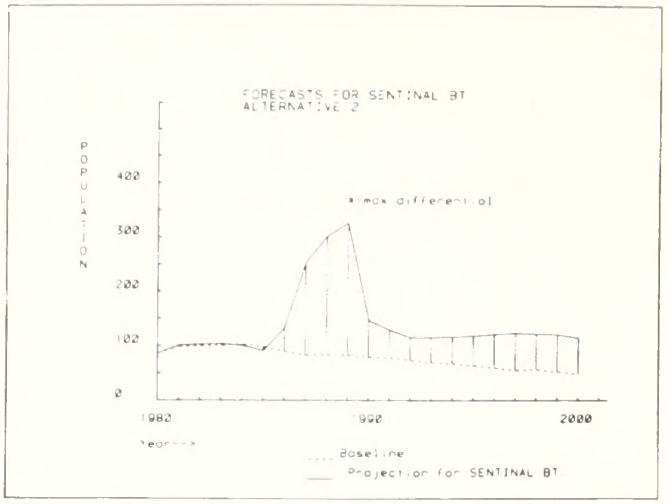
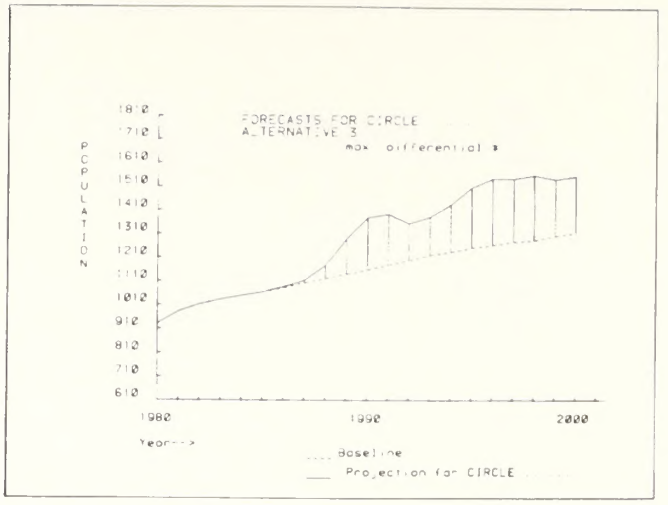
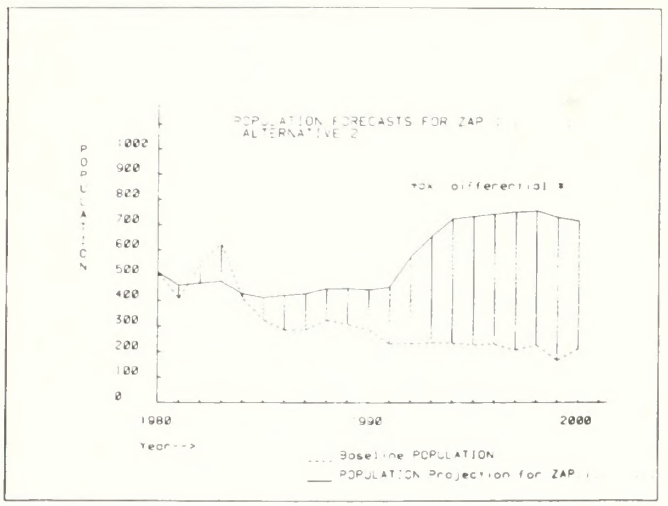
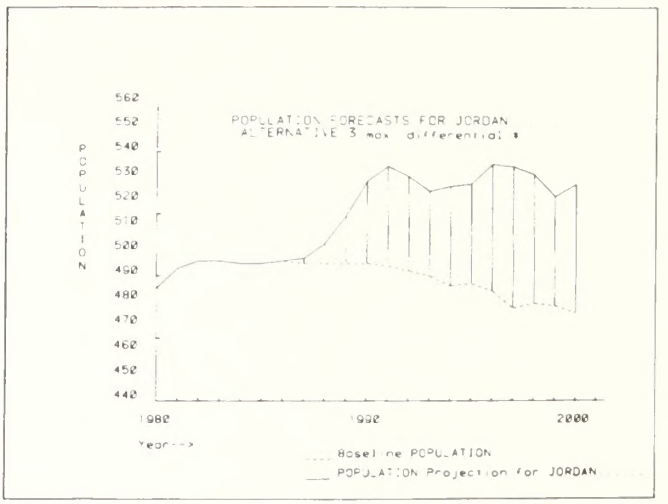
1990
2000
Baseline
Projection for KILLDEER









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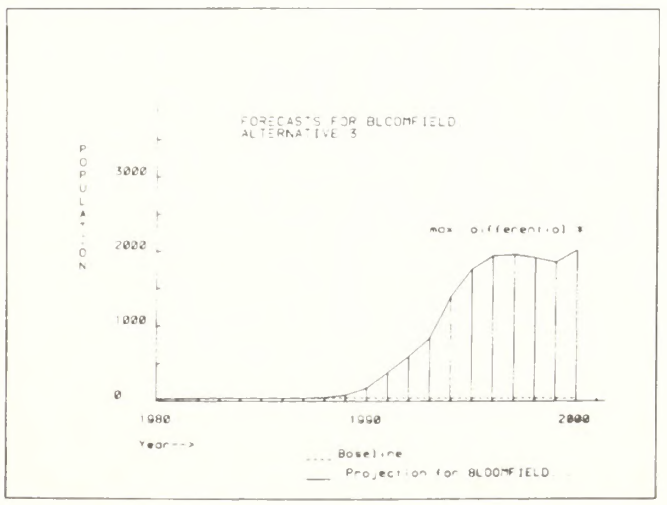

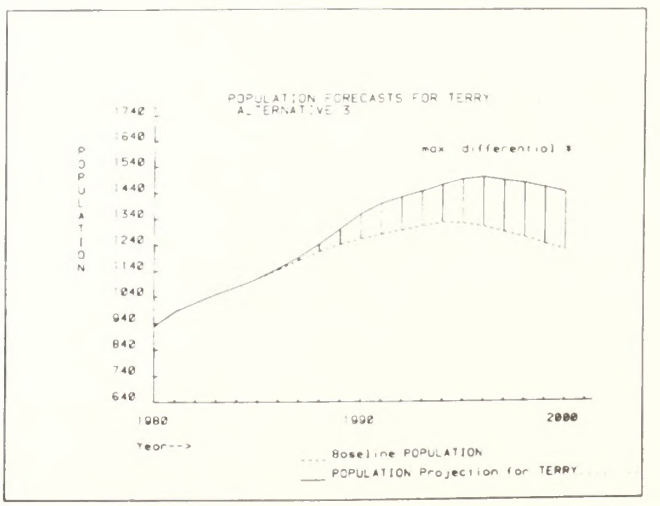

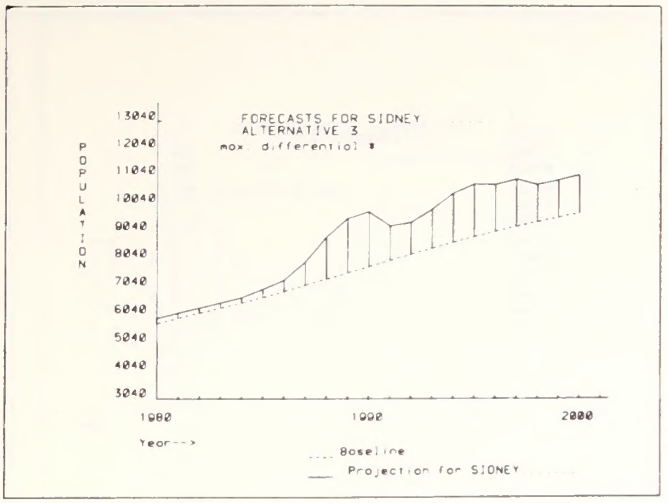

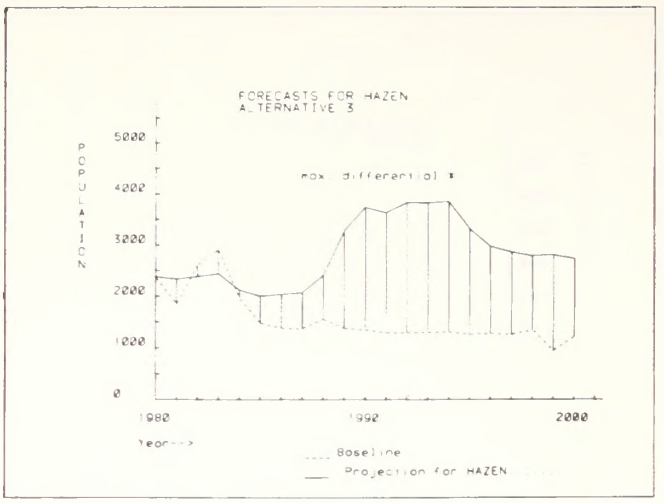

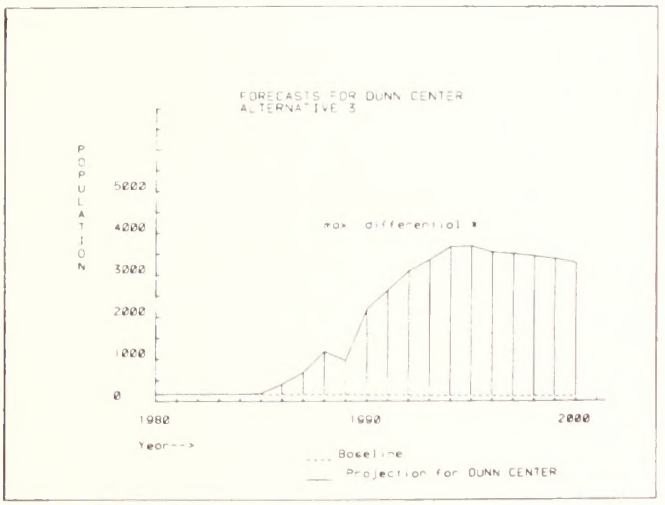

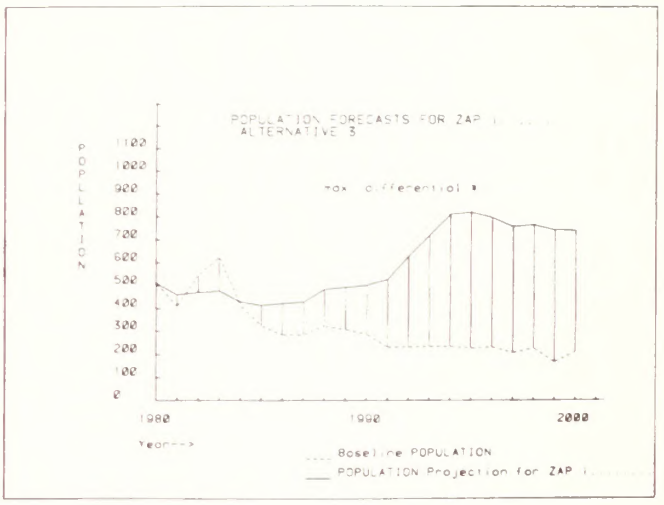

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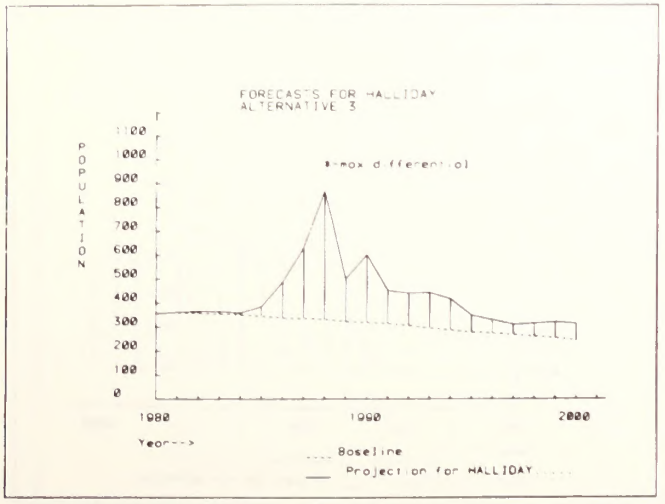

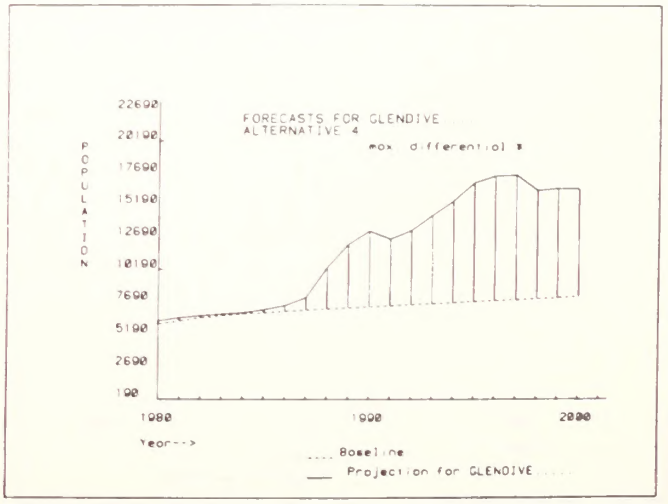

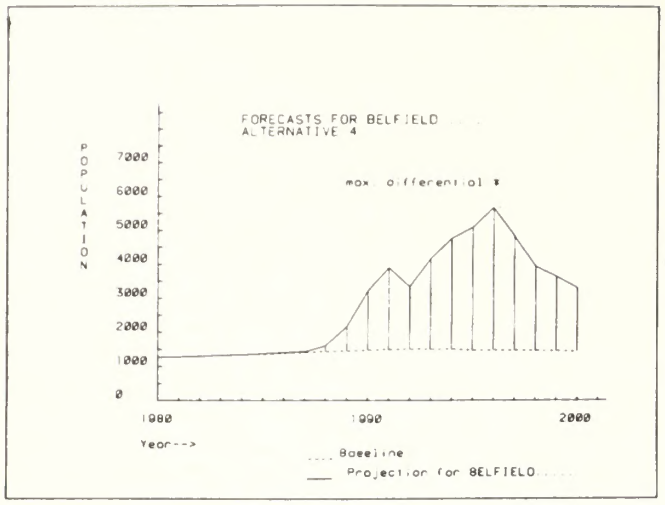

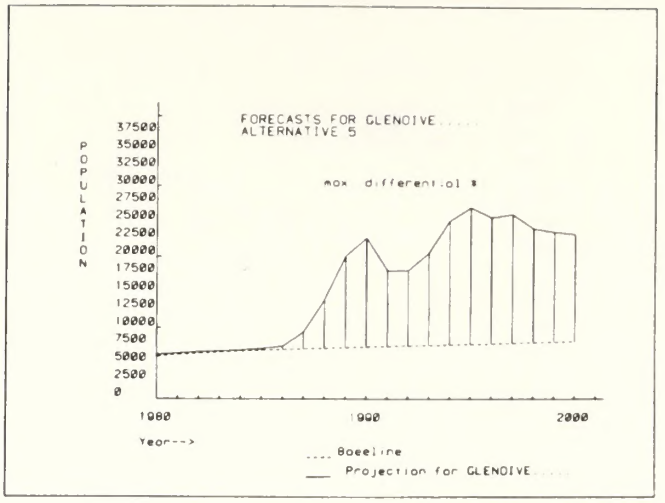

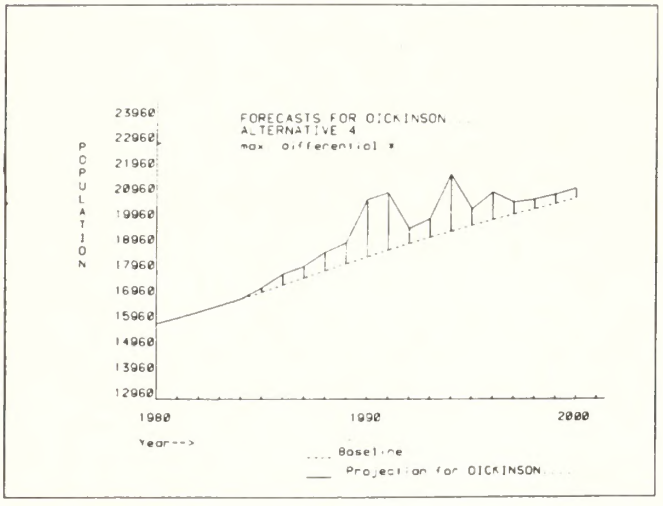

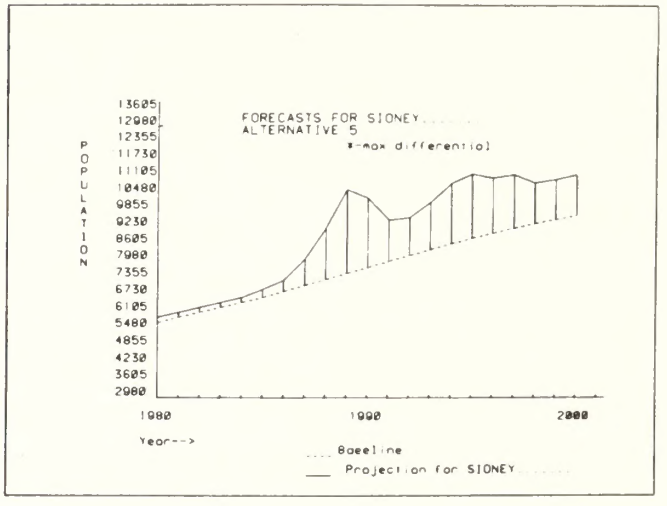

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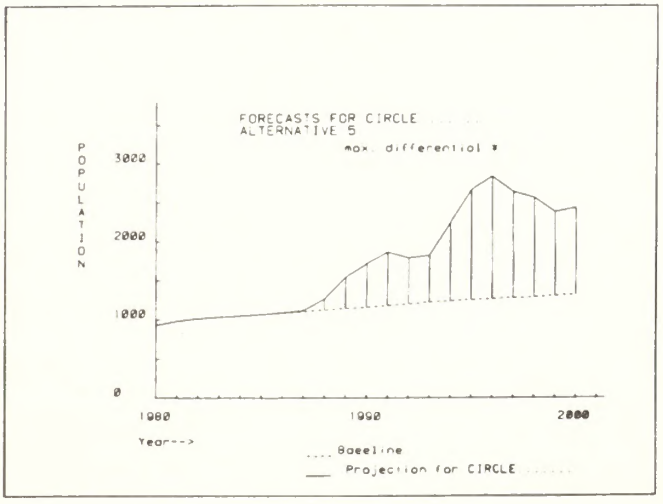

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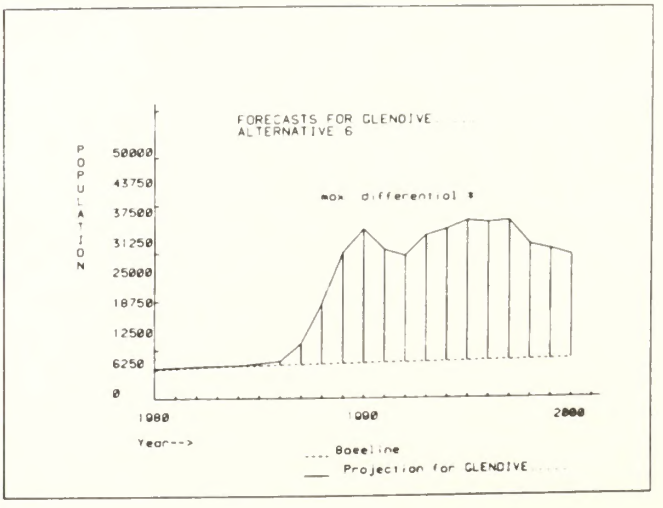
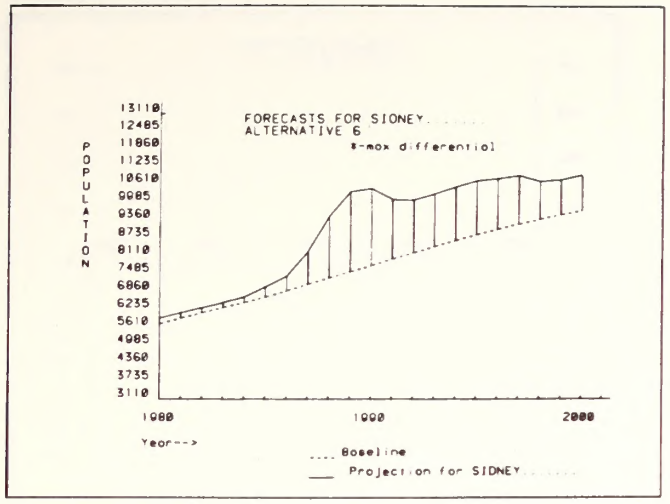
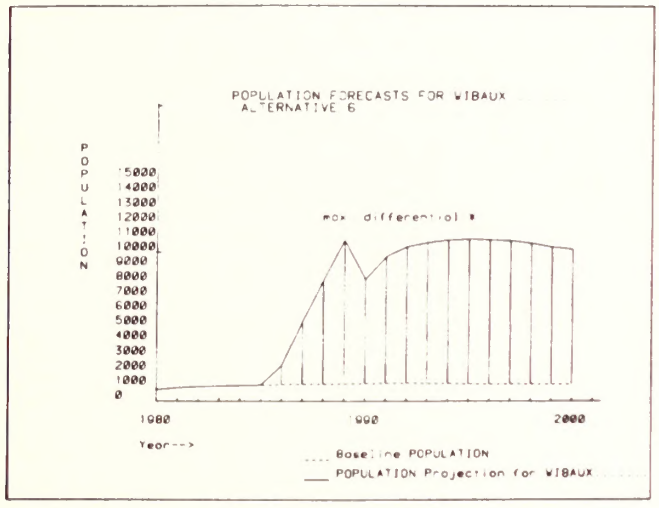



FORECASTS FOR SIONEY
ALTERNATIVE 6
*-mox differentiol
POPULATION
13110
12485
11860
11235
10610
9985
9360
8735
8110
7485
6860
6235
5610
4985
4360
3735
3110
1980
1990
2000
Year-->
Boseline
Projection for SIDNEY


POPULATION FORECASTS FOR WIBAUX
ALTERNATIVE 6
POPULATION
mox differentiol *
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14000
13000
12000
11000
10000
9000
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7000
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5000
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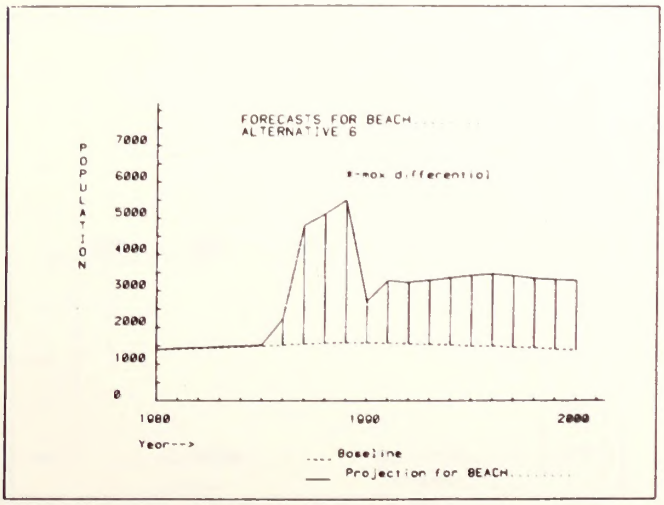
2000
1000
0
1980
1990
2000
Year-->
Boseline POPULATION
POPULATION Projection for WIBAUX


FORECASTS FOR BEACH
ALTERNATIVE 6
*-mox differentiol
POPULATION
7000
6000
5000
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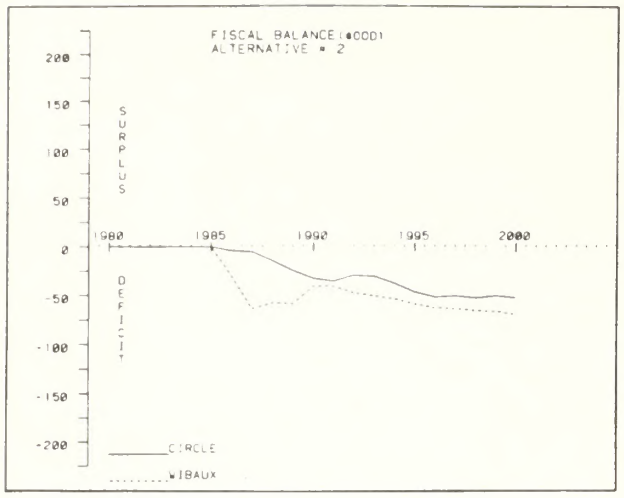
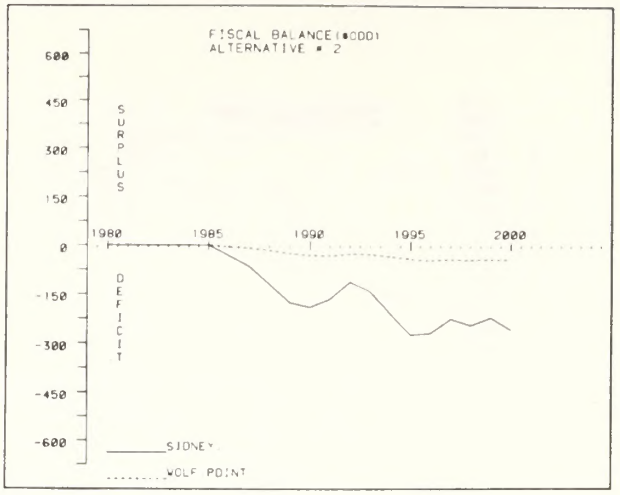
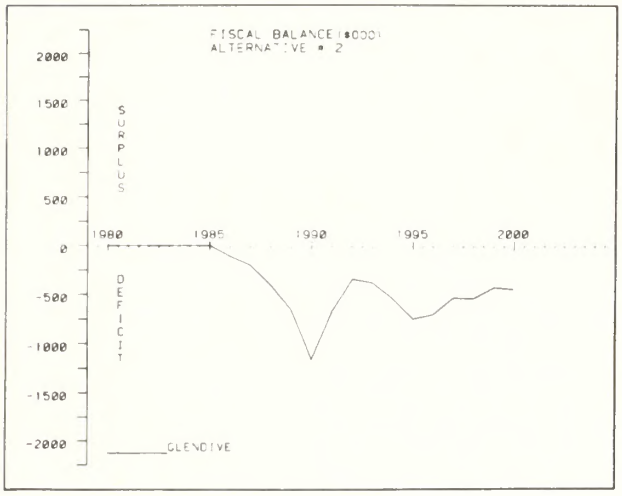
3000
2000
1000
0
1980
1990
2000
Year-->
Boseline
Projection for BEACH

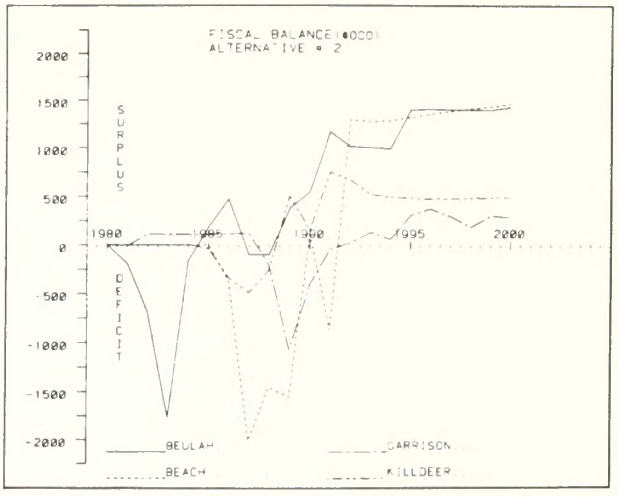
APPENDIX H

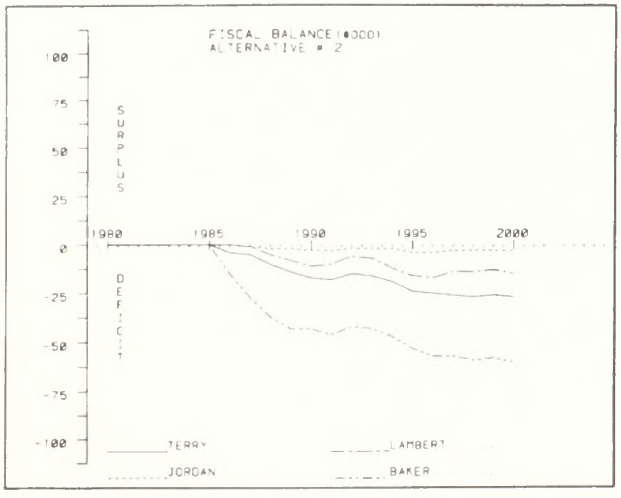
ALTERNATIVE 2

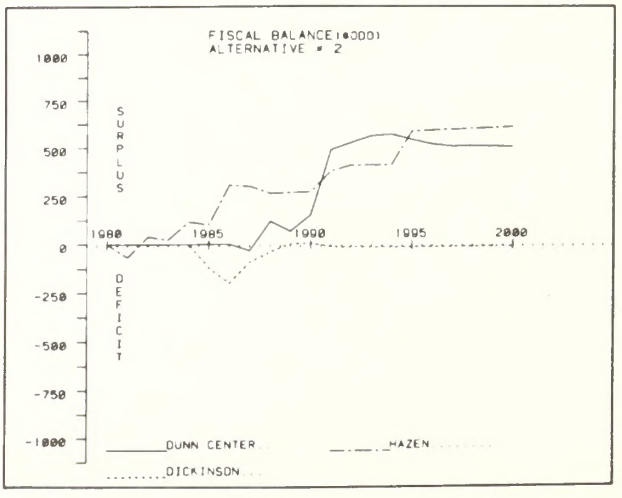












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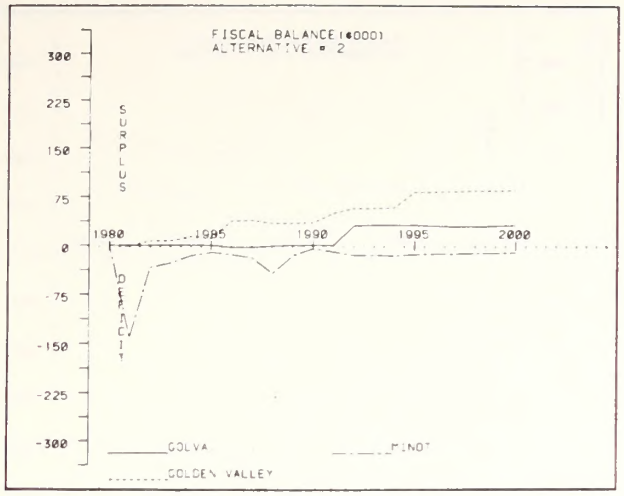

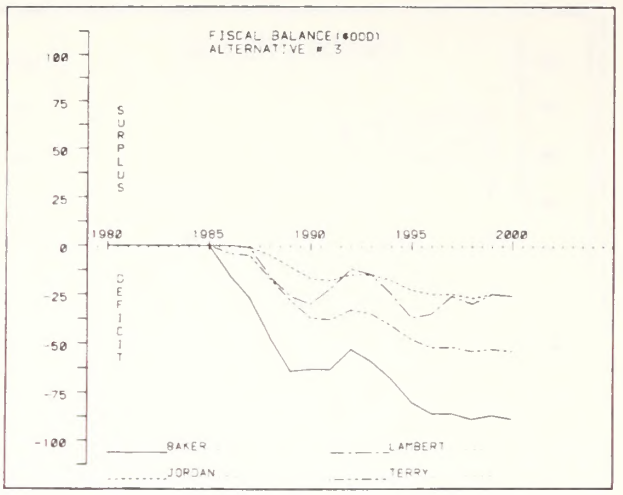

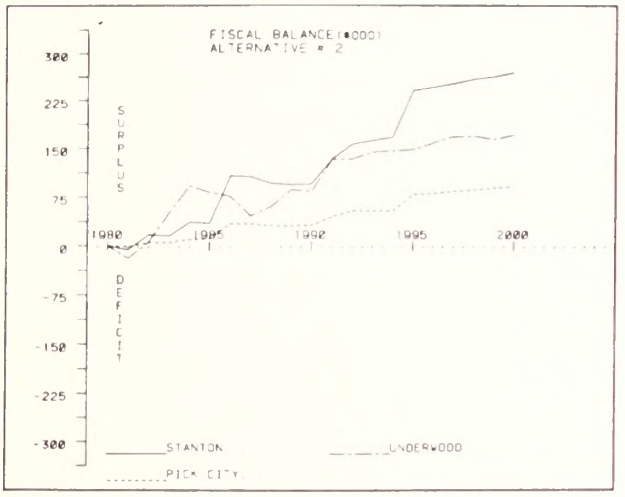

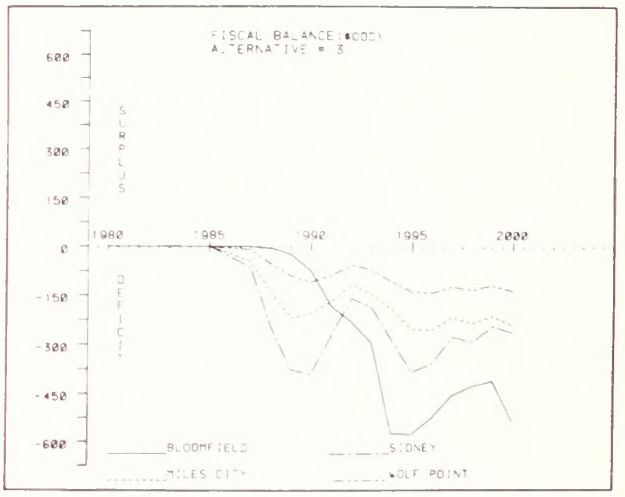

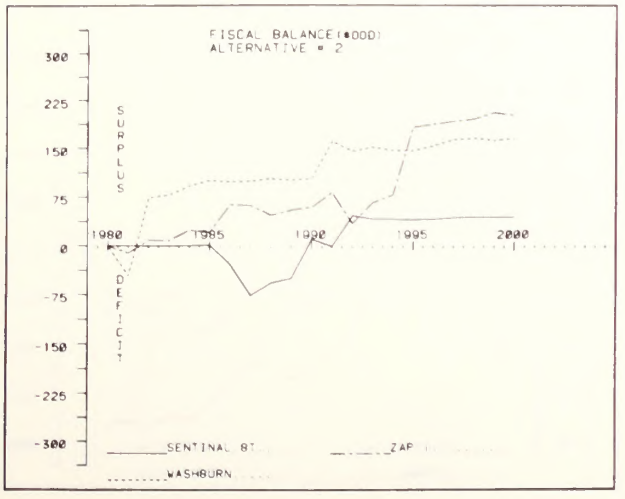

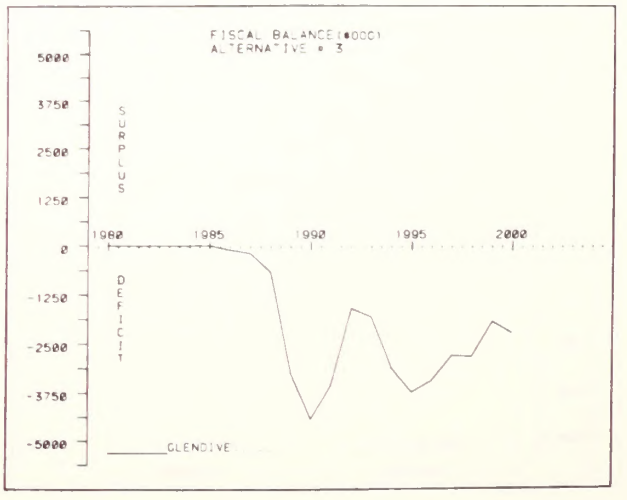

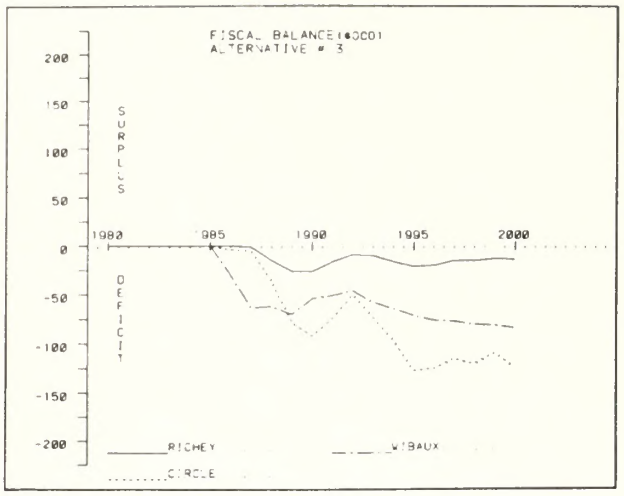

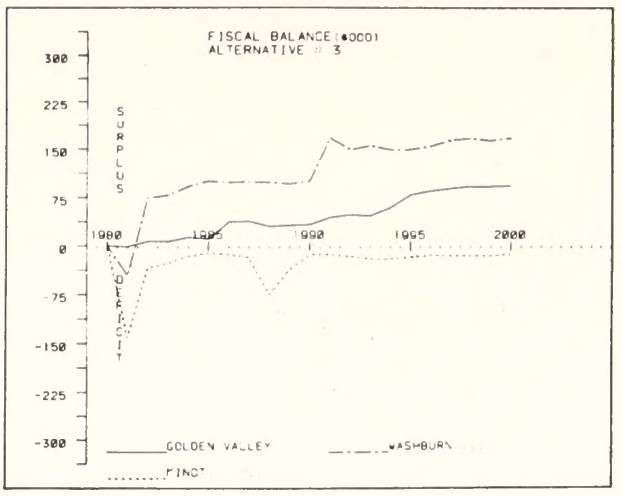

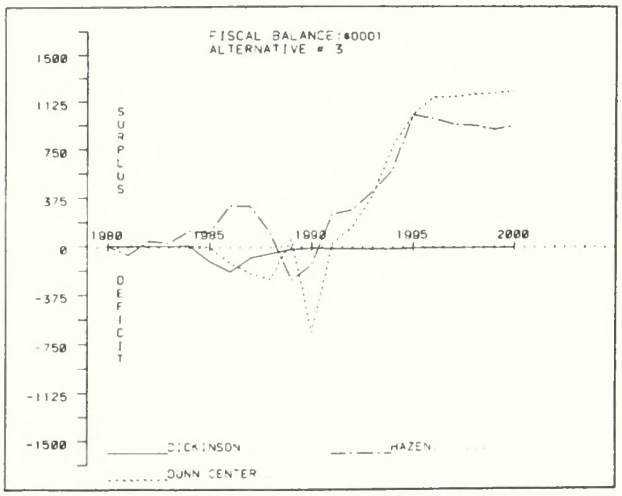

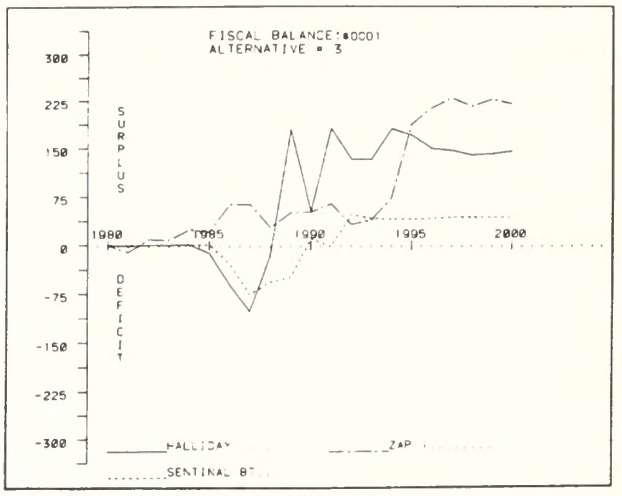

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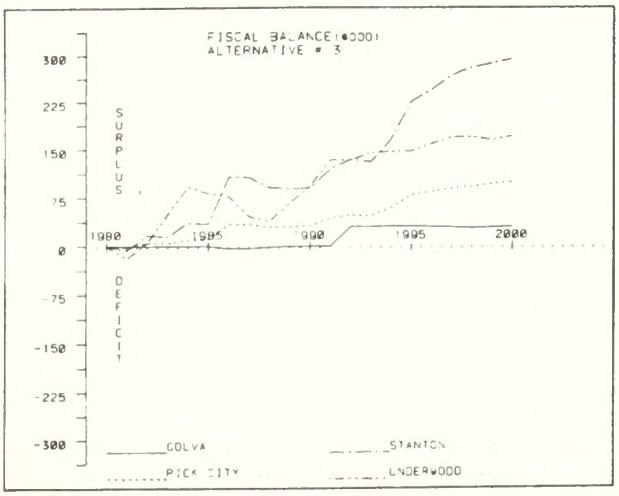

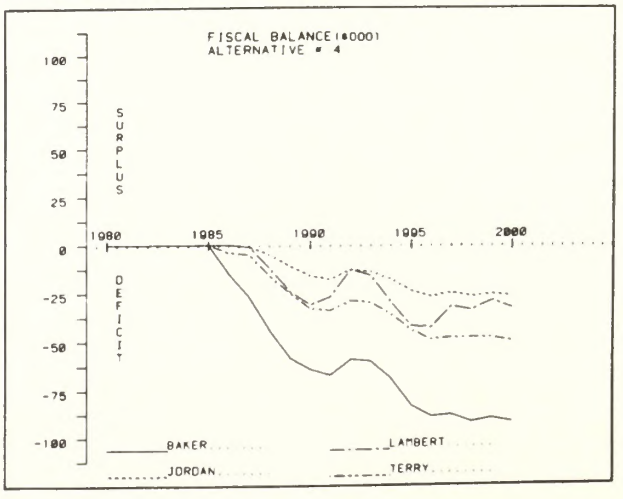

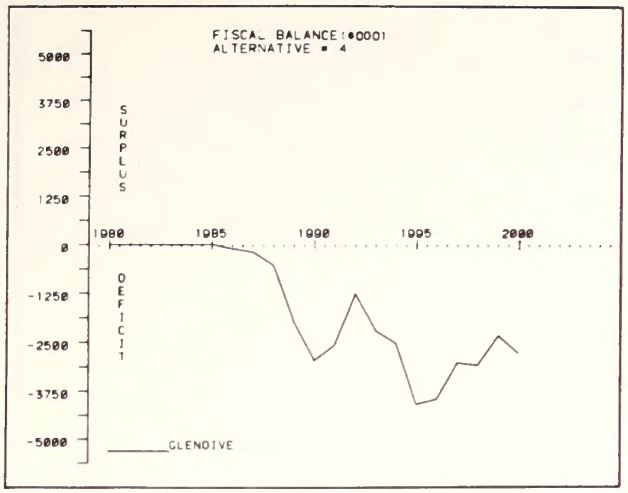
FISCAL BALANCE(*0001)
ALTERNATIVE # 4
SURPLUS
DEFICIT
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2500
1250
0
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-2500
-3750
-5000
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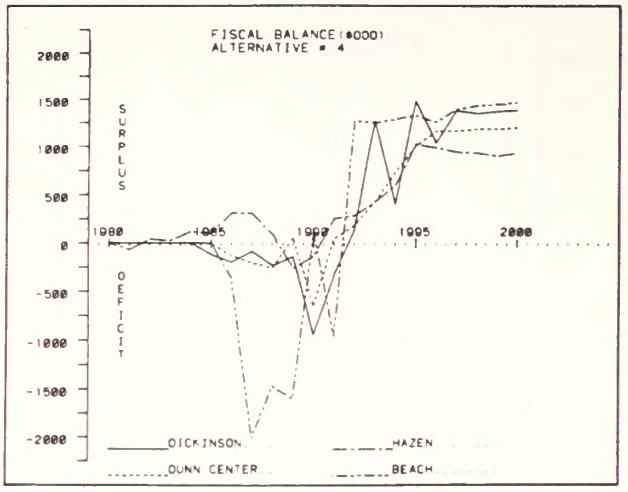
1985
1990
1995
2000
GLENDIVE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DEFICIT
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1990
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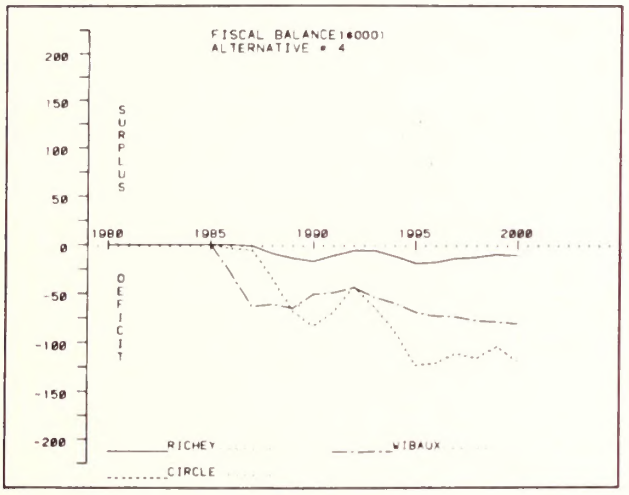
2000
DICKINSON
HAZEN
DUNN CENTER
BEACH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DEFICIT
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-200
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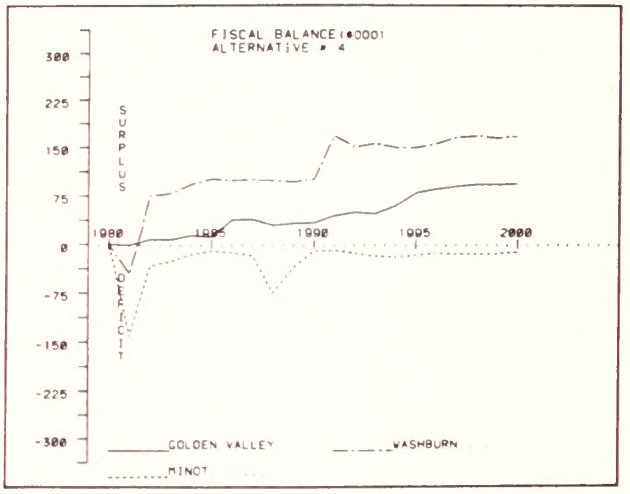
1985
1990
1995
2000
RICHEY
WIBAUX
CIRCLE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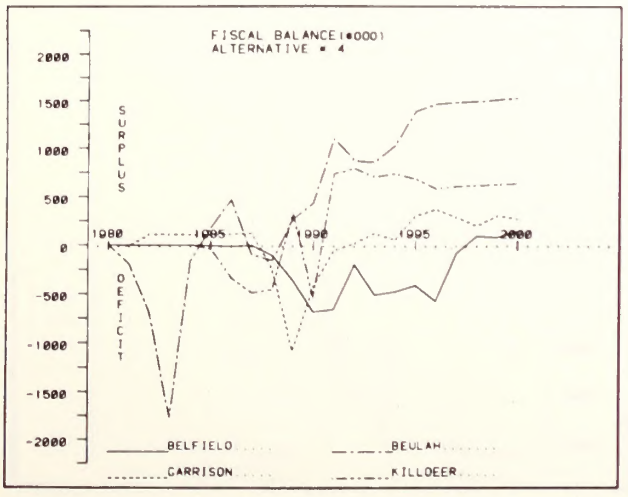
1990
1995
2000
GOLDEN VALLEY
WASHBURN
MINOT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DEFICIT
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-2000
1980
1985
1990
1995
2000
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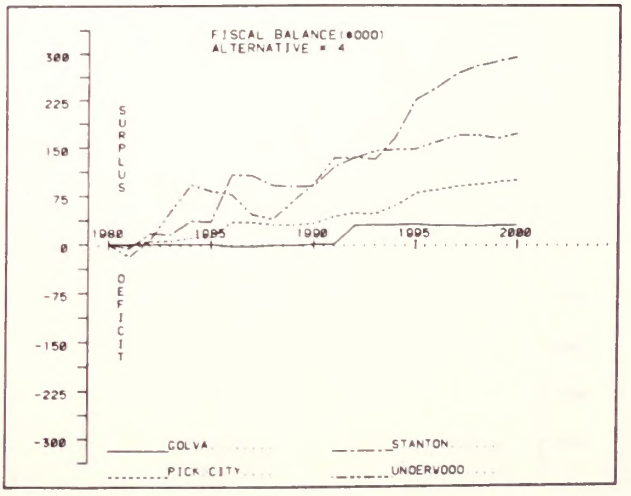
BEULAH
GARRISON
KILLDEER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2000
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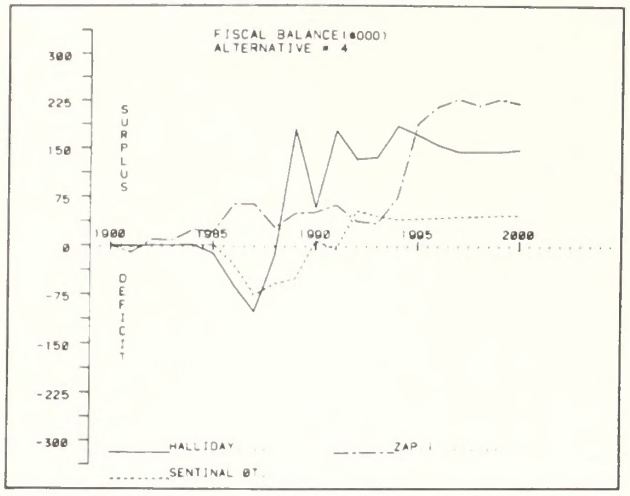
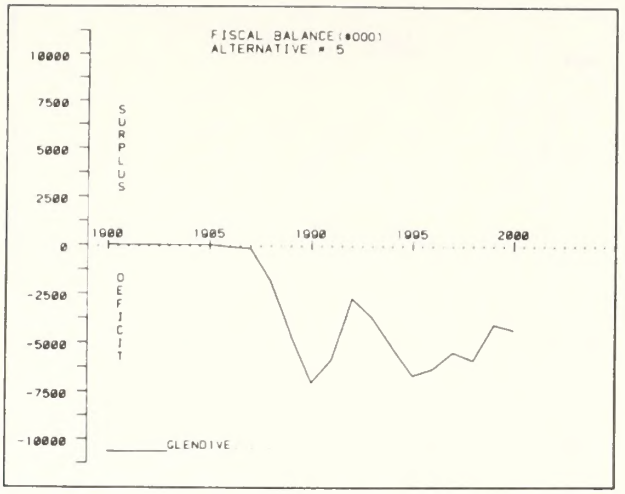
STANTON
PICK CITY
UNDERWOOD





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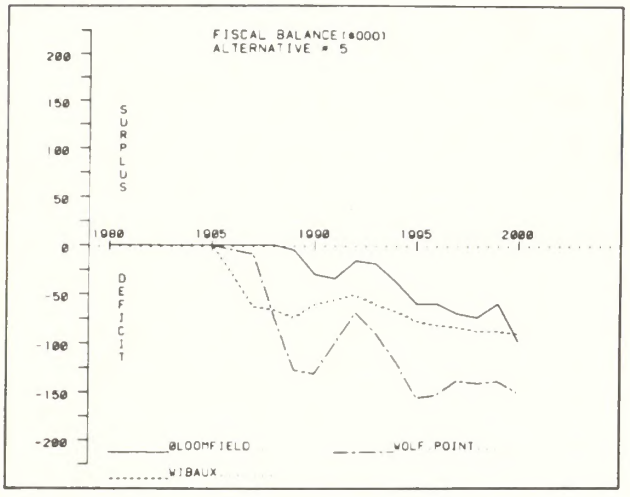

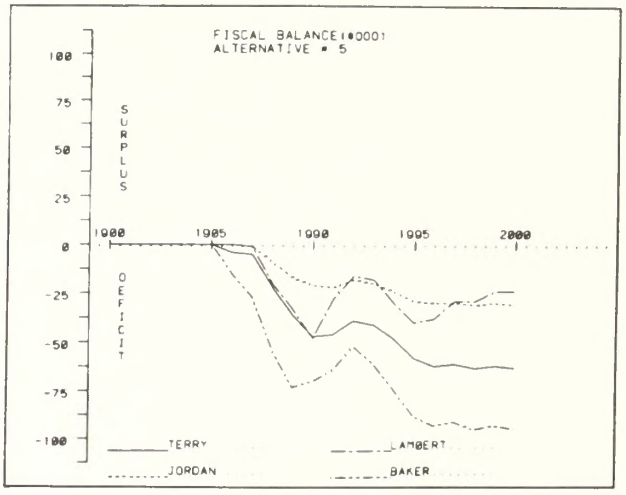

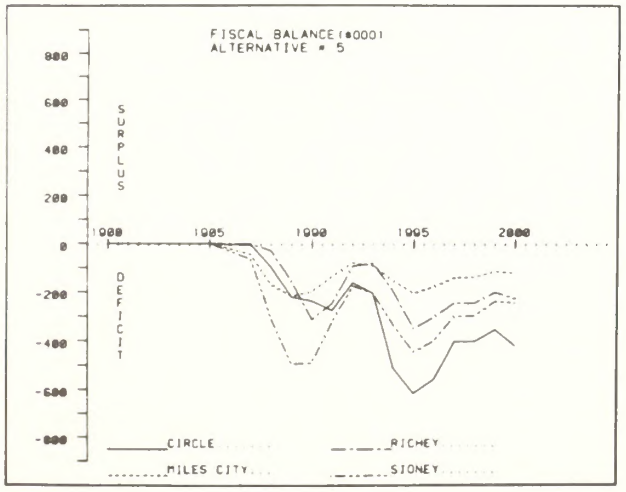

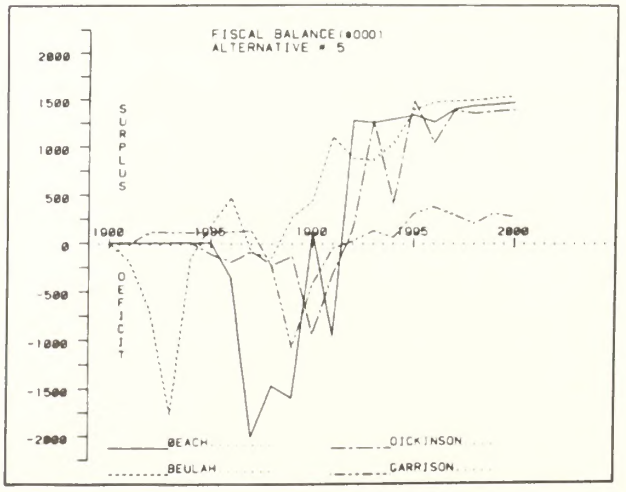

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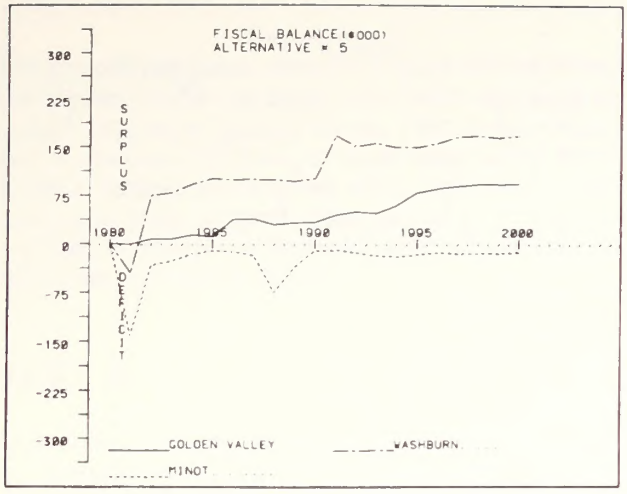

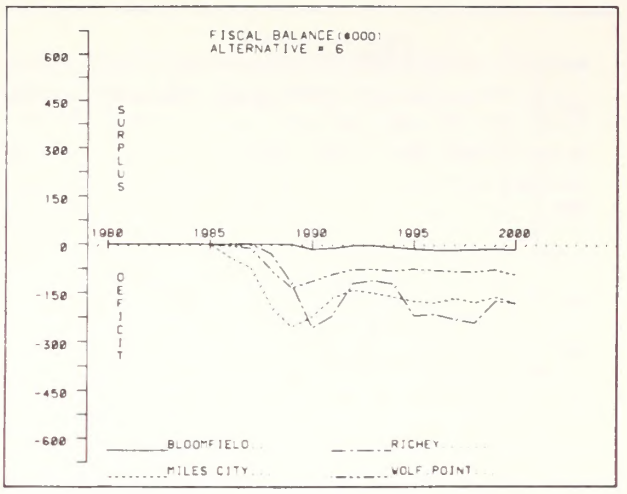

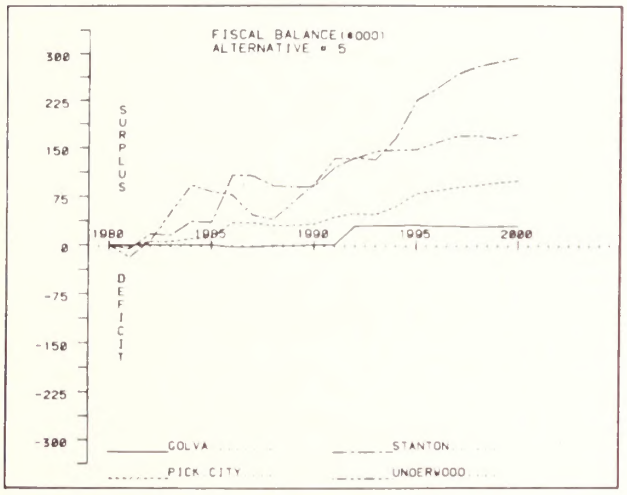

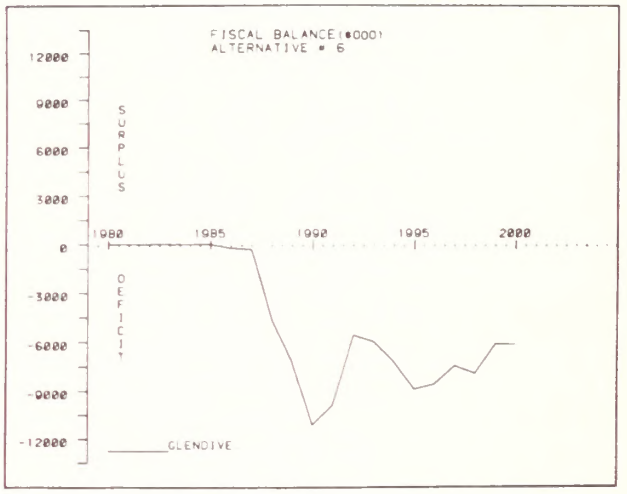

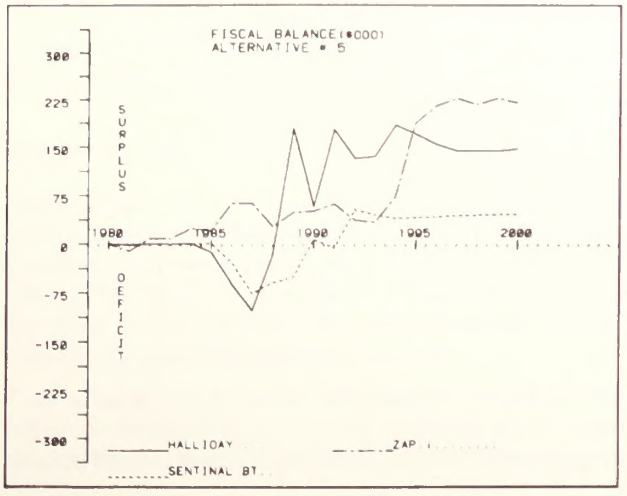

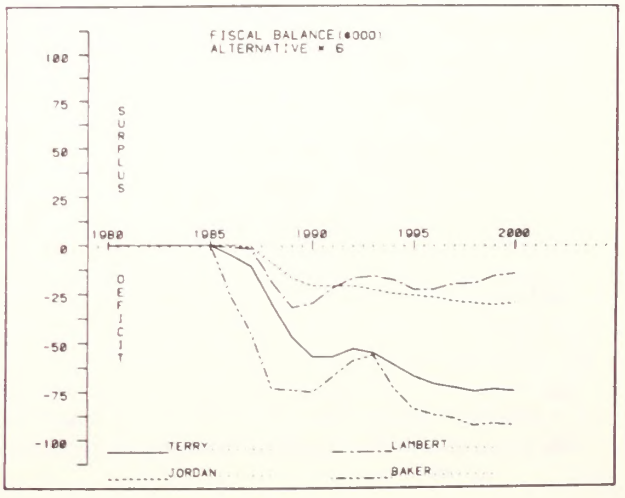

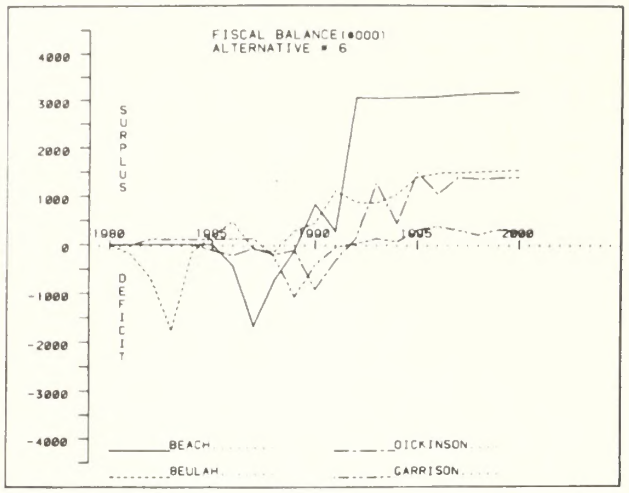
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DEFICIT
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-3000
-4000
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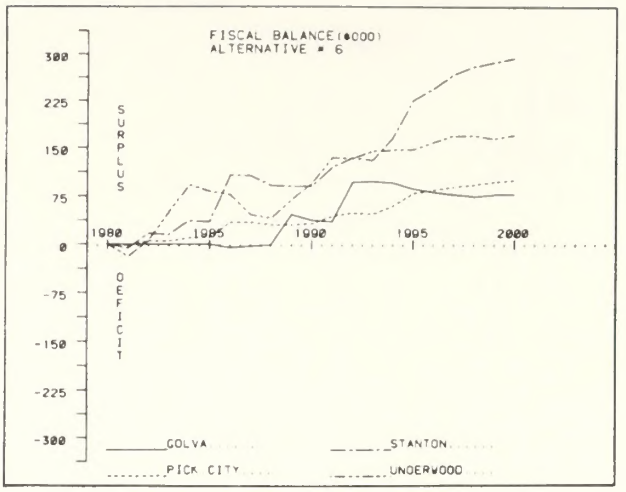
1985
1990
1995
2000
BEACH
DICKINSON
BEULAH
GARRISON


FISCAL BALANCE(*0001)
ALTERNATIVE = 6
SURPLUS
DEFICIT
300
225
150
75
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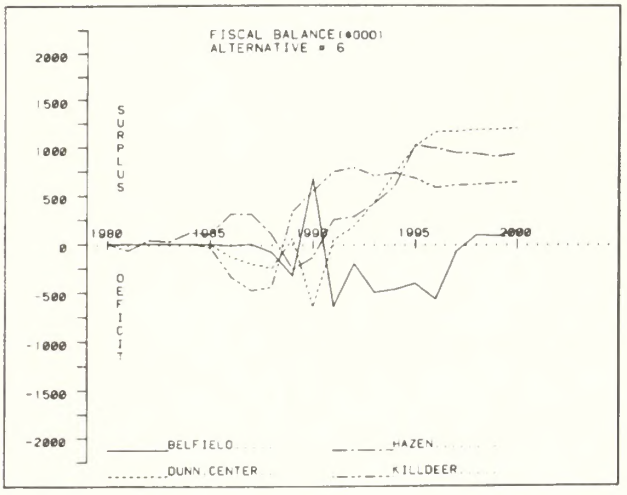
-150
-225
-300
1980
1985
1990
1995
2000
GOLVA
STANTON
PICK CITY
UNDERWOOD


FISCAL BALANCE(*0001)
ALTERNATIVE = 6
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DEFICIT
2000
1500
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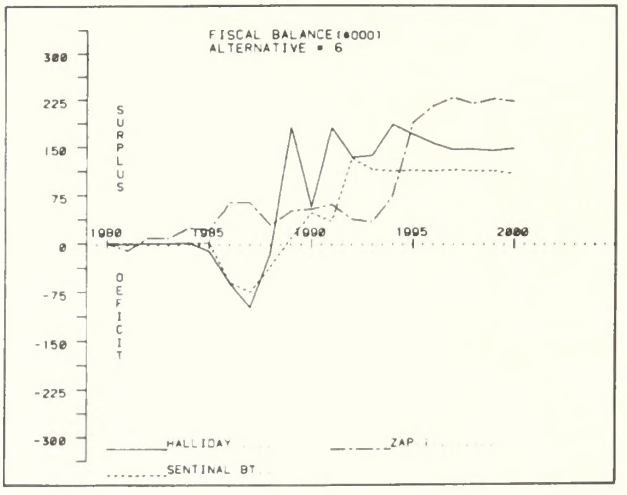
1980
1985
1990
1995
2000
BELFIELD
HAZEN
DUNN CENTER
KILLDEER


FISCAL BALANCE(*0001)
ALTERNATIVE = 6
SURPLUS
DEFICIT
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150
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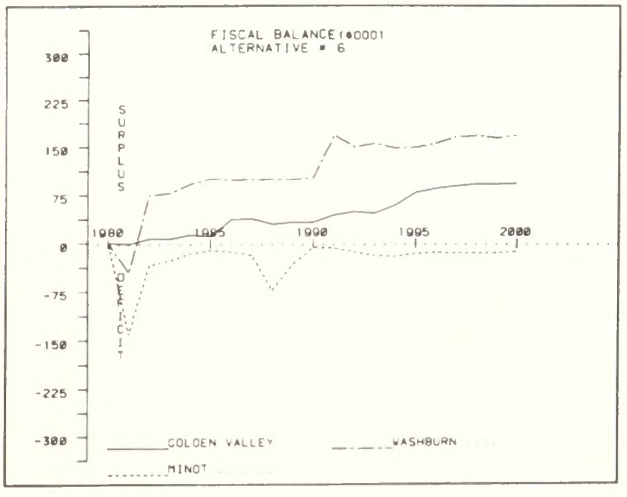
1980
1985
1990
1995
2000
HALLIDAY
ZAP
SENTINAL BT


FISCAL BALANCE(*0001)
ALTERNATIVE = 6
SURPLUS
DEFICIT
300
225
150
75
0
-75
-150
-225
-300
1980
1985
1990
1995
2000
GOLDEN VALLEY
WASHBURN
MINOT

APPENDIX I

The impact mitigation described in the following section is presented in two basic parts. Part A deals with an overall mitigation strategy for the Fort Union Region and is discussed in terms of application to the North Dakota portion of the study area. Part B discusses existing funding program, strategies and both federal and state technical and financial assistance which applies to the Fort Union Region.

PART A

Fort Union coal tract development will eventually help to diversify the economy of the Fort Union region. Secondary and tertiary expansion, due to new energy growth, will result in a sectoral change from an agricultural to a construction-trade oriented economy. On the community level this will translate into a broader range of goods and services being offered and greater employment opportunities; however, in the short run, impact costs incurred with energy growth may well exceed base tax revenues.

Short-term, energy-related impacts may have an adverse effect on baseline municipal services in some of the communities identified and adequate planning and management capabilities are essential in developing mitigation strategies. The lack of adequate planning may result in fiscal problems, inadequate investment in community infrastructure, and a decrease in the quality of life.

There appear to be five critical factors that must be present to mitigate some of the adverse economic or social impacts that would result from rapid energy growth. These factors are only applicable to the mitigation of community service impacts. They include:

1. Accurate information
2. Adequate lead time
3. Planning expertise
4. Adequate financial resources
5. Political leadership

If any of these five factors are missing, it is likely that a community will not be able to significantly alleviate the adverse effects of energy related growth.

Accurate Information

County and community elected and appointed officials need reliable up-to-date information on the size, timing, location, and workforce requirements of proposed energy facility/mining projects. This information is essential before substantial commitments can be made to upgrade community services.

One source for accurate information would be the NEPA mandated assessments required for environmental impact statements. Most proposed energy projects in the Fort Union would involve utilization of federal resources (minerals, lands, water) and would fall under the NEPA requirements; however, specific criticisms cited (Murdock and Leistritz, 1979) show that information generated under the NEPA process does not adequately meet the information needs of impacted areas.

As a supplement to NEPA, the siting process employed by the State of North Dakota is another source of usable planning information. The Energy Conversion and Transmission Facility Siting Act (NDCC 49-19) is administered by the North Dakota Public Service Commission (PSC).

Under the Act, a certificate of site compatability must be obtained before construction and operation can begin. The application for a certificate contains detailed impact data, a description of mitigative measures that will be taken to minimize impacts resulting from the location, construction, and operational phase of the proposed facility, and other information that the PSC may require. Special conditions, terms, or modifications may be revoked for failure to comply with the special stipulations.

The existing regulatory framework developed to implement the Siting Act gives the PSC flexibility in requiring consultation and coordination among the various actors. In one example involving Mercer County, the PSC, upon granting site compatability certificates for two electrical generation facilities, required the utilities involved to provide project impact data on a regular basis to the local planning agency.

County and local political subdivisions appear to have the option to develop consultation and coordination requirements by amending existing zoning ordinances. The Siting Act provides that a certificate of site compatability shall not supercede or preempt local land use, zoning, building rules, regulations, or ordinances, and that no site shall be designated which violates these provisions.

All counties have the essential planning mechanisms needed to interface with provisions of the Siting Act; however, the degree of county and local involvement in developing an agressive consultation/coordination role largely depends on PSC involvement. Future decisions similar to that arrived at in Mercer County in 1978 may or may not be the standard. Changes in the state political climate since that time could be a major limiting factor. If this is the case, county and local involvement will need to be more aggressively pursued.

Industry initiative in establishing voluntary consultation/coordination efforts is a factor which must be considered. An outgrowth of the PSC Mercer County decision, voluntary efforts by involved utility companies led to the formation of the Inter-Industry Technical Assistance Team (ITAT). The ITAT efforts have established a monitoring program to collect project workforce data.

A forecasting model has been developed and provides updated planning information on a semi-annual basis. The information is made available at no cost to elected and appointed officials, interested agencies, and individuals.

Industry initiative, as outlined in the ITAT approach, has possible application. Given the current siting laws and the planning interface mechanism with counties and political subdivisions, it appears that industry would be encouraged to develop a voluntary approach. Policy criteria developed by the PSC for use in evaluating site permit applications include the following critical elements:

1. recycling of the conversion byproducts and effluents
2. energy conservation through location, process, and design
3. training and utilization of available labor in this state for the general and specialized skills required
4. use of a primary energy source or raw material located within the state
5. nonrelocation of residents
6. the dedication of an area adjacent to the facility to land uses such as recreation, agriculture, or wildlife management
7. economics of construction
8. secondary uses of appropriate associated facilities for recreation and the enhancement of wildlife
9. use of citizen coordinating committees
10. a commitment of a portion of the energy produced for use in this state
11. labor relations
12. monitoring program
13. the coordination of facilities

The PSC may give a preference to an application that will maximize benefits that result from their adoption and in a proper case may require their adoption.

From the siting provisions it suggests that industry is encouraged to develop a voluntary consultation/coordination program; however, there is the major problem of trying to accurately define the impact area location.

Extensive oil and gas development has impacted many rural areas and communities in southwestern North Dakota, and with the added impacts of coal development, it may be difficult to fund an ITAT based effort. If such a scenario develops, the case for active local, regional, and state involvement becomes stronger. Consequences to industry may be a loss of options in formulating a suitable cost-effective approach.

Adequate Lead Time

The general employment patterns (Figure 1) for Fort Union related energy projects will show a peak workforce during the construction or startup phase. Only a residual number of employees will be needed during the operational life of the facility. Given the baseline municipal services for the communities that will be impacted by coal tract development, adequate lead time is needed to develop and implement growth management strategies.

Utilities which plan to own, operate, or start construction on any facility are required to submit long-range or 10-year plans. Two crucial items which the plan must list are the location of the tentative preferred site and a description of efforts to involve land use planning agencies in the planning process. The long-range plans provide a source of early information into local planning efforts; however, in order for lead time to be of any real value to the community, they must have a firm commitment that the project will go forward. Without it, capitol improvements and expenditures cannot be adequately funded.

Prior to the issuance of site certification, active planning involvement to mitigate social and infrastructure impacts must be scheduled. Crucial decisions concerning facility construction schedules can be analyzed by the local actors to determine cumulative impacts. Alternatives such as phasing projects (spreading the construction schedule to reduce these impacts) can be more fully evaulated. In general, early planning involvement is essential. At site permit issuance, critical construction programming will have been made, and substantial industry resources will have been committed.

Under the siting program, utilities planning to construct an energy conversion facility must submit a letter of intent to the commission. The filing should occur at least one year prior to the filing of an application for a certificate unless a shorter time period is approved. Critical items contained include:

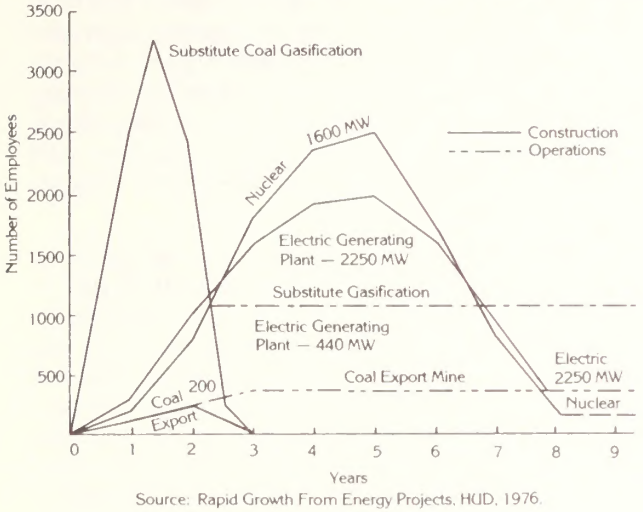
1. a description of the size and type of facility
2. a map of the study area for the proposed site
3. the anticipated construction and operation schedule
4. the estimate of the total cost of construction

Upon submission of the site permit application, the PSC will make a determination of its completeness. After acceptance, the PSC shall serve a notice of filing to persons and agencies that the commission deems appropriate. The notice will also be published in the official newspaper of each county in which any portion of the site is proposed to be located.

A lag time exists between the time required for filing the letter of intent and the formal submission and acceptance by the PSC of the site application. During this time the applicant is not required to publish any formal notice of facility planning involvement. The interim time is used by industry to complete the studies required for inclusion into the application and this is also the time that local actors should be brought into the planning process to consult with the utility to exchange needed planning information and to propose alternatives for

evaluation. The siting provisions do not specify that additional copies of the letter of intent be sent to involved parties. Such a procedure, if adopted on an informal basis to notify the involved actors of impending developments, could serve as the needed lead time indicator to communities.

FIGURE 1 EMPLOYMENT PATTERNS FOR SELECTED ENERGY PROJECTS



Source: Rapid Growth From Energy Projects, HUD, 1976.

Planning Expertise

Communities or counties that undergo rapid growth usually find that the actual costs of hiring or maintaining adequate planning staffs is one of the best investments they can make in their futures. Experienced planners, who are attuned to the needs of all potentially effected community interests, can aid in predicting and analyzing future growth problems, developing effective and feasible solutions to these problems, and working with community leaders and other governmental and industry representatives to insure the application of the best available mitigation strategies in their communities. Qualified planning staffs and adequate planning budgets are only effective; however, if the community ultimately supports their efforts—that is, if local decision makers utilize their analyses in making decisions or eventually implement long-range comprehensive plans.

In the Fort Union region the availability and competence of planners is generally considered to be adequate for current needs, but in most cases budget and staff resources would be severely strained under a maximum leasing alternative.

In North Dakota the existence of nonprofit, multicounty regional planning commissions, such as Lewis and Clark and Roosevelt-Custer Development Councils, provides an alternative for local communities or counties that do not currently have the need or the funds to hire full-time planners. If rapid growth was to occur simultaneously in many communities in the region as is projected under several of the alternatives in this document, it is likely that the budget and staff levels of these planning commissions would be exceeded. This possibility would be particularly likely if the present tenuous financial status of the regional planning commissions is not reversed in the near future. In any case, smaller communities such as Beach and Killdeer, if they experience rapid and intense population growth, would likely find it necessary to hire full-time community planners to cope with local growth-related problems.

In Montana local governments do not have the benefit of regional planning commissions for planning support. Richland and Dawson counties presently have full-time county planners, while planning consultants are used in McCone and Wibaux counties. If communities such as Circle and Wibaux are impacted by moderate to heavy population increases, it is likely they would also find it necessary to hire full-time community planners to deal with future growth problems.

Available Financial Resources

Energy impacted communities have limited financial resources needed to offset the cumulative impacts associated with energy facility construction. The funding, to be of any real value, needs to be made available before a major population influx occurs.

Planning and growth management capabilities are necessary in order to plan, and budget for needed facilities and services, and fiscal strategies reflected in the capital improvements program outlines how local, state, and federal resources will be used. A deficiency in critical planning elements (lead time, information, and expertise) may delay needed federal and state funds.

The 1981 Catalog of Domestic Federal assistance lists 1081 grant/loan programs administered by 52 federal agencies. Efforts within the federal system are oriented towards integrating overlapping categorical programs into block grant areas. With block grants, the state has more control over the use of federal monies. Grant applications have also been simplified.

The range of federal programs offering impact assistance is limited and energy impacted communities wishing to upgrade planning capabilities, public facilities, or social and human services may not qualify. Grant programs, such as those administered by the Economic Development Administration (EDA), have eligibility requirements (i.e., low income, population out-migration, high unemployment) tailored for economically depressed areas. Others such as the Community Development Block Grant Program (CDBG),

administered by the Department of Housing and Urban Development (HUD), are oriented towards low and moderate income families. Loans and grants available from agencies such as the Environmental Protection Agency (EPA) and the Farmers Home Administration (FmHA) can be used to upgrade municipal services and to finance housing for people of low to moderate income. Funds for upgrading planning capabilities have been reduced or eliminated. The CDBG funding alloted for planning is being reduced. Programs eliminated include the HUD "701" program and the EDA Title V Regional Planning Commissions. Social and human service block grant programs administered by federal agencies such as the Department of Health and Human Services will have funding levels reduced after FY83. A more indepth description of grant programs traditionally used in community development, planning, and human service programs is covered in Appendix A.

The overall federal role in grant/loan programs is in the process of being redefined. The reduction of an active federal presence places a greater burden on state and local resources. In its 1981 session, the North Dakota State Legislature amended earlier enabling legislation to create and expand the powers of the Energy Development Impact Office (EIO). The EIO administers grants and loans to areas experiencing negative impacts associated with energy development. Appropriations for the EIO come from the Coal Severence Tax, Coal Conversion Tax, Oil and Gas Production Tax, and the Oil and Gas Extraction Tax.

Two types of impact assistance addressed by the EIO involve coal and oil and gas. Funding appropriations for the 1981-1983 legislative biennium are:

1. coal — $12,000,000
2. oil and gas — $10,000,000

Funding provided to coal impacted areas can either take the form of a grant or loan. In applying for these funds, the political subdivision must show:

1. that the proposed project is necessary because of the negative impacts of coal development
2. that the project will alleviate the problems identified
3. that financial need can be demonstrated

Projects eligible for consideration must be for basic governmental services. Excluded by statute from this category are the non-basic or secondary services, such as social and human service programs. The extent to which the project proposals meet the above criteria and the current funding available determines the degree of grant funding.

To qualify for impact loans, the subdivisions must be receiving coal severence tax monies. The maximum borrowing capacity of the subdivision is limited by its percentage share of the coal severence tax paid to coal producing counties. Repayment of the loan is based upon a 6 percent interest rate. The payment schedule is based on a minimum 10 percent deduction from each coal severence tax allocation made to that city, county, or school district, and in the event that coal production permanently ceases, the loan amount outstanding will be canceled.

The general concern of state impact programs is over the "big ticket" items such as municipal infrastructure and services. At the point that these items are funded, it generally comes too late in the planning process. The subdivisions are placed in a reactive position and have limited flexibility in determining the direction of growth. With federal planning grant cuts, existing federal/state programs provide little support for upgrading planning and growth management capabilities. Since many smaller communities in the Fort Union Region would find the services of a full-time planner not to be cost effective, a regional approach is required.

Area planning agencies and the regional planning councils rely strictly on local contributions from participating units of government. At the risk of over or under investment by governmental units, access to needed grantsmanship and growth management expertise and more efficient utilization of limited state and local financial capital, priority funding must be maintained to area planning agencies at a level which would permit retention of an ongoing planning capability adequate to meet the needs of the region.

Competition for limited tax capital will continue to increase as energy development in the Fort Union intensifies. For example, in the 1979-1981 biennium, 137 grant applications were filed with the EIO then known as the Coal Development Impact Office. Of the total, 42 percent were approved for total or partial funding. Overall grant requests totaled $16,422,168 and the amount awarded totaled $2,852,844. Local options to raise needed tax capital are limited to the property tax levy. As a part of the legislation establishing the Coal Conversion Tax, energy facilities were classified as personal property and are exempted from any additional property tax. The local government can only collect property taxes on land owned by the facility. The Coal Severence Tax does not exempt mines from local property taxes; however, equipment such as trucks and drag lines would be exempted as personal property.

Given the existing political climate, potential passage of additional revenue enhancing measures is limited. Combined with federal cutbacks, the impetus will be on local initiative to generate needed revenues to make possible short-falls. The largest potential source of new tax revenues lies in the area of a minerals tax. Currently, North Dakota counties in the Fort Union Region have no mineral valuation provisions in the property tax structure. The North Dakota statutes give the counties taxing authority in this area; however, county auditors are reluctant to add any add valorum tax. State real

estate and forfeiture laws require ownership transfer (to the county or new owner) if delinquent property taxes are not paid within five years, and delinquent property owners are notified by registered letter. Enforcement of a mineral valuation component would be complicated by problems in assessing severed or fractional mineral ownership, but the mineral valuation concept tied to existing property tax programs offers a broader range of financial options for the county to investigate.

Political Leadership

The effectiveness and decisiveness of local state leadership in addressing and solving growth-related problems and coordinating community response to changes can be one of the most critical factors in determining whether or not development is a positive experience for a community.

Those communities which have undergone prior development of a similar nature or scale as that proposed in the Fort Union EIS have a distinct advantage, if impacted, because leaders have knowledge of the types of problems they can expect to encounter, and most likely have many, if not all, of the necessary processes and structures in place to control and monitor the change. Even these communities may have significant problems with additional growth if they do not have the cooperation of the community at large, or if efforts between local governments (city, county and state) or between local governments and coal companies are not carefully negotiated and maintained.

Through the establishment of strong outside ties to county and state governments, local leaders can increase their community's potential for acquiring grants, loans, and other assistance to help finance capital facilities and other services. In addition, aggressive and unified approaches to company negotiations can help to insure such positive results as front end money for services and facilities, guarantee of jobs, and sharing of information.

Through their efforts to mobilize community resources (e.g., financial institutions) and to push for the expansion of local businesses, community leaders can also insure that many of the benefits which result from increased income and spending power ultimately stay within the community.

Most significant, however, is the potential for effective local leadership to provide the objectivity needed to mediate or resolve community conflicts that may surface or intensify as a result of changes which are occurring in their communities. The ability to negotiate equitable trade-offs is especially valuable during chaotic peak construction periods when choices often need to be made between alternative courses of action, each of which impose some hardship on some community interests. Community conflict, if it is left unchecked, will make the transition periods especially traumatic for both newcomers and established residents and will almost certainly affect the relationship that a community is able to strike with industry. Leadership that can create positive environments for newcomers while maintaining open access to the political structure for longtime residents will ultimately have a positive impact on residents' attitudes toward their communities and toward development itself.

PART B

Mitigating measures designed to reduce or eliminate economic and social impacts fall into the categories of technical or financial assistance from both federal and state sources.

Federal: Technical Assistance

Technical assistance to coal area communities has been available from the Mountain Plains Energy Impact Office, but this office was terminated because of recent federal budget cuts. In the past, the chief supporters of the Energy Impact Office have been the Department of Housing and Urban Development (HUD), the Department of Energy (DOE), and the Environmental Protection Agency (EPA).

The HUD, DOE, EPA, the Department of Labor, and the United States Geological Survey have all developed impact assessment techniques, prepared publications, or presented workshops to assist state, regional, and local governments to develop understanding and skills in the process of impact assessment, planning, and mitigation. However, no current efforts are underway. Two publications which remain useful despite the major changes underway in the federal system are the EPA funded *Action Handbook for Managing Growth in Small Communities* and the USGS/ Missouri River Basin Commission's *Western Coal Planning Assistance Project* series.

At this point, because of federal budget cuts, it is unclear whether in the future any federal agencies will be committed to providing technical assistance to state and local governments in energy impact areas.

Federal: Financial Assistance

The only specific federal source of financial assistance to coal impact areas has been the very limited Farmers Home Administration 601 program which began in 1979. The FmHA 601 program provides grants to designated, approved coal impact areas for planning, for site acquisition and development, for public facilities and services, and for housing on sites owned by a city or county. (FmHA is currently involved in litigation over

the eligibility of housing authorities as applicants.) Planning grants may be 100 percent federal money, but site acquisition and development grants require at least a 25 percent local match.

To be designated, an area must have had an eight percent increase in eligible coal related employment during the preceding calendar year or must anticipate an eight percent increase in each of the next three calendar years. Eligible employment is defined as full time employment in the production, transportations or processing of coal. The definition of coal processing specifically excludes conversion of coal into electrical energy. The growth in employment must have caused or be expected to cause substantial adverse social or economic impacts, such as shortages in housing or public facilities or services. Available state and local financial resources must be inadequate to meet the needs resulting from coal development. The designated areas in Montana include only Big Horn, Carbon, Custer, Musselshell, Powder River, Rosebud, Treasure, and Yellowstone counties.

To be funded, site acquisition and development projects must be: (1) adequately referenced in a growth management plan approved by FmHA, and (2) included in the Governor's State Investment Strategy which recommends project priorities for the FmHA 601 program.

The 601 program is administered by the State FmHA office. Allocations are made to each state office based on a formula that includes actual and percentage increases in eligible employment, the project funding requests of the state investment strategy, and the planning requirements of the state. Nationally, no more than 10 percent of each year's appropriation may be used for planning.

To date, the FmHA 601 appropriations and the allocations to Montana and North Dakota have been as follows:

TABLE 1

Federal Fiscal Year	National Appropriation	Allocations Montana	North Dakota
1979	$20,000,000	$ 286,000	$ 769,000
1980	50,000,000	1,205,000	2,020,000
1981	10,000,000	342,000	?

In 1980, Montana reverted $858,450 to the national FmHA office because eligible local governments chose not to pursue projects, whether because of the slump in coal activity, difficulties in selling local bonds because of high interest rates, or for other reasons.

It appears that the FmHA 601 program is now, for practical purposes, defunct.

While many federal programs are geared toward metropolitan areas and areas of economic decline, assistance has been available to Montana's rural communities through HUD, FmHA, EPA, and the Heritage, Conservation, and Recreation Service (formerly BOR) to alleviate some of their public facility, low-moderate income housing, and recreation needs. The future of these programs is in question, as is the future of the human service programs that depend largely on federal funding sources. Major budget cuts appear inevitable but how, for whom, and by whom the remaining funds will be allocated has not yet been resolved. The State of Montana has assumed responsibility for the HUD Community Development Block Grant Program, $6.1 million for FY82, and it is likely that it will be maintained at that level. The target group is low and moderate income earners. Other federal programs are severely cut or terminated.

For many years, the states received 37-1/2 percent of the federal mineral leasing royalties, and these funds were to be used for schools and highways. Several years ago, Congress increased the states' portion to 50 percent. The additional 12-1/2 percent was intended to alleviate the impacts of federal mineral development. Montana added its 12-1/2 percent to its school foundation program funding which allocates monies to schools in the state on a formula basis which reflects changes in student population. Two or three proposals are being considered to "redirect" the 12-1/2 percent portion to the local level, but the outcome is uncertain at this time.

Montana: Technical Assistance

The Montana Department of Community Affairs, especially through its community development division, has provided technical assistance to communities in the coal resource areas of southcentral and eastern Montana. This has included direct assistance to local government officials, boards, and staff as well as publications, workshops, training sessions in local planning and impact assessment, land use regulation, subdivision review, growth management and impact mitigation techniques, housing and public transportation needs, local government finance and fiscal management, funding sources for planning and public facilities, and overall community and economic development. The DCA also has served as an advocate for local governments with both state and federal agencies.

The nature and extent of the continued assistance to local governments is currently under review as part of the transition from the terminating Department of Community Affairs to the newly created Department of Commerce. The specific directions and functions of the new department should be established within the next few weeks.

Primarily through its eaastern Montana field office, the Department of Social and Rehabilitative Services has been helping eastern Montana communities assess and plan for human service impacts. Other state agency and non-profit corporation human service planners and providers have also been increasingly concerned about the human service needs in rapid growth areas; however, the effects of federal funding cutback leave open the question of who will be able to provide what kinds of services to whom. The Coal Board has received several major human service applications this year.

Montana: Financial Assistance

In Montana, financial assistance is available to local governments which have been required to expand the provision of public services as a consequence of large-scale development of coal mines and coal-using energy complexes. Funded by 8.7 percent of the revenue from Montana's coal severance tax, the Montana Coal Board may award grants to local governmental units and state agencies to assist local governmental units in meeting the local impact of coal development by enabling them to adequately provide governmental services and facilities which are needed as a direct consequence of coal development. Grants are to be awarded on the basis of need, degree of severity of impact from coal development, availability of funds, and degree of local effort in meeting these needs. The Coal Board's enabling legislation allows consideration of local mill levies and bond issues to be waived when impact assessment and planning grants are being considered.

From its inception in 1975 through May, 1982, the Montana Coal Board awarded 115 grants for a total of $35,245,542. These grants were matched by $35,453,026 in local funds. Most of the Board's grants to date have been for the construction of schools, water and sewer systems, and law enforcement, fire, and emergency services facilities. The Board has also helped to purchase law enforcement and fire fighting vehicles and solid waste disposal and road maintenance equipment. In the Board's early years a few very small human service grants were funded, but the Board has recently funded its first major human service applications. The coal impact assistance grant program appropriations for fiscal years 1981 and 1982 were $7,222,025 and $9,324,444, respectively. If severence tax revenues exceed expectations, the Board may apply to the Governor's Office of Budget and Program Planning to increase its spending authority within the 8.75 percent authorization.

While the Coal Board is able to exercise wide discretion in its grant-making process, it does operate under certain statutory or policy constraints. The Board is not authorized to make loans, as opposed to grants, nor can it provide private sector housing assistance. It has functioned with an unofficial policy against funding either land acquisition or public sector housing although the Board has assisted Big Horn County to provide housing for its road crews in the isolated southern part of the county.

In the past, the state has had no means of focusing financial resources on the housing needs of rapid growth communities. The Montana Board of Housing is attempting to effect a revision in federal policy concerning the Mortgage Subsidy Bond Tax Act which would allow the Board to utilize its funds in rapid growth areas. This effort has been unsuccessful so far.

Although impacts are not expected to occur on any of the Indian reservations in or near the Fort Union Region, mitigation of economic and social impacts upon Indian reservations must be addressed in those cases where impacts are expected to occur. To do this requires an assessment of impacts and an understanding of what sources are available for impact mitigation. The availability of Indian set-aside money from various federal agency sources and grant monies which could benefit tribes is an area which must be understood if impact mitigation is to be successful on reservations. A department by department review of these considerations can be found in the *Handbook of Federal Responsibility to Indian Communities in Areas of Environmental Protection and Individual Health and Safety*, Americans for Indian Opportunity, Albuquerque, New Mexico, 12/81.

APPENDIX J

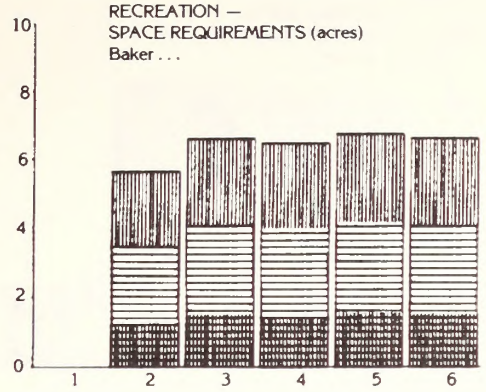
Community recreation facilities are structure or land-based forms. Structures are utilized for group activities as family gatherings, service club meetings, community service activities, etc. Land-based forms generally consist of three categories: playgrounds, neighborhood parks, and community open space. Because of uncertain costs in design and function, the land-based form is valuable in determining the trends in land requirements.

The Department of Energy has developed a method of calculating estimated demand for community land use. This method was used which identifies the long-term allocation of land and was not figured from peak population. The calculations are shown for the major communities most likely impacted by coal-related development.

Playground	=	total population x 1.8 acres per 1,000 population
Neighborhood Parks	=	total population x 3.0 acres per 1,000 population
Community Open Space	=	total population x 3.7 acres per 1,000 population
Total Land Requirement	=	Playgrounds + Neighborhood Parks + Open Space

LEGEND

Recreation Land Use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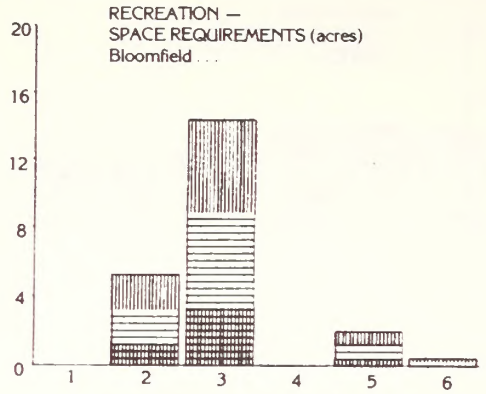
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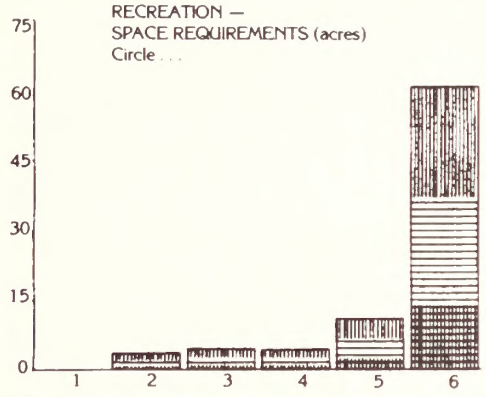
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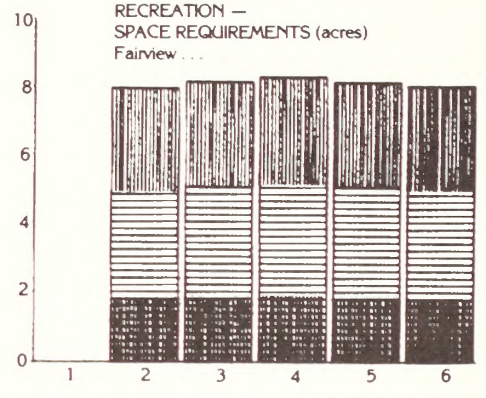
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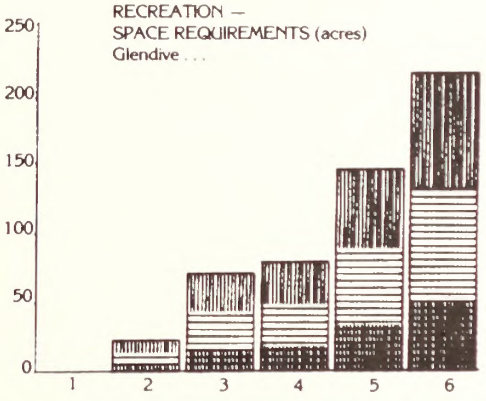
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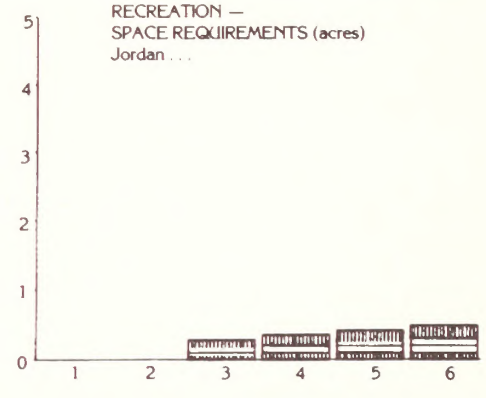
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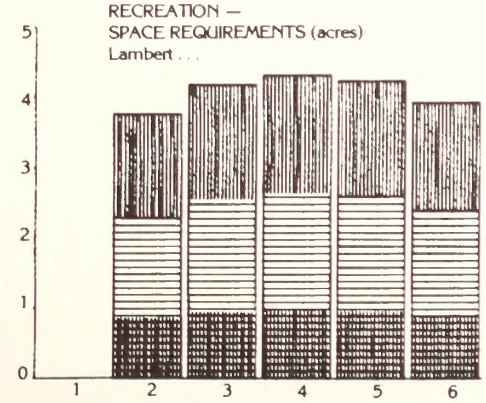
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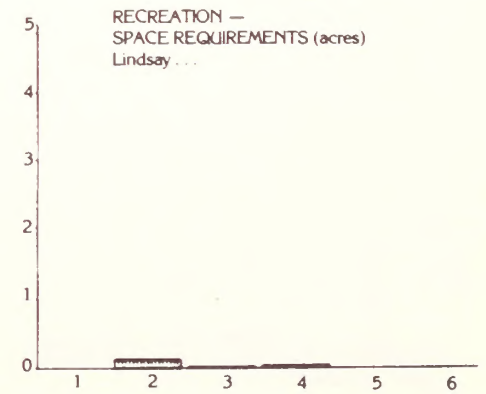
RECREATION —
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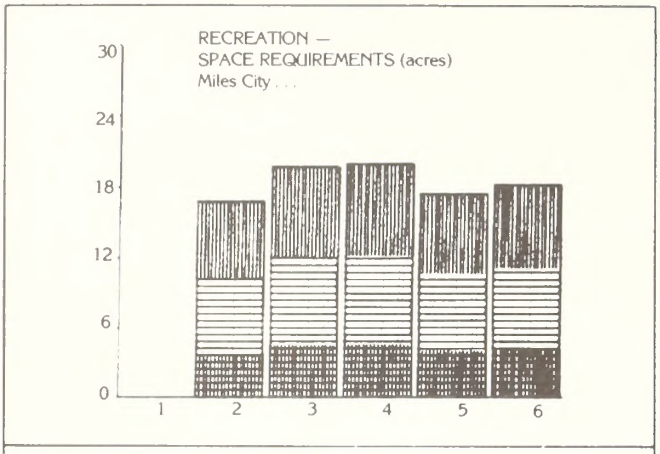
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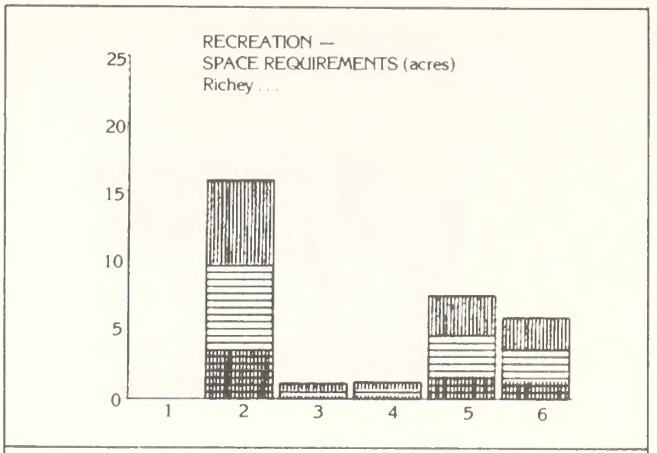
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Richey . . .
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10
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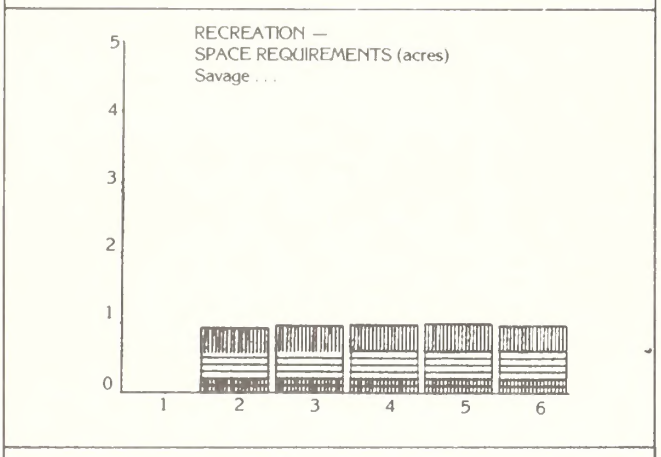
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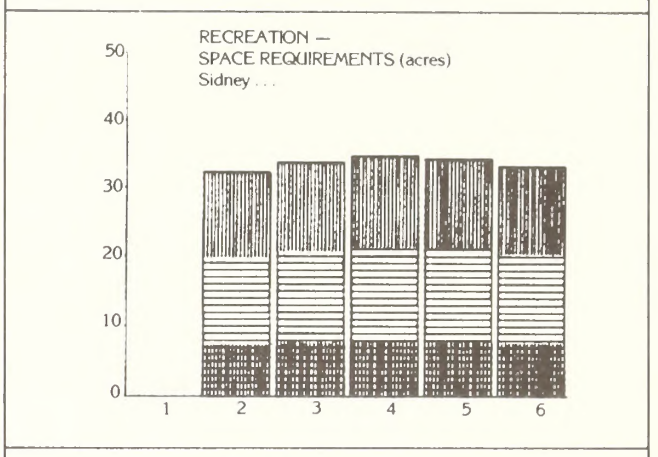
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Sidney . . .
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5
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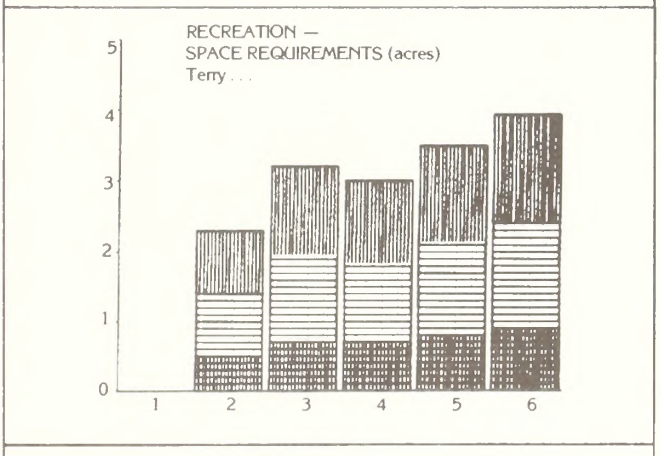
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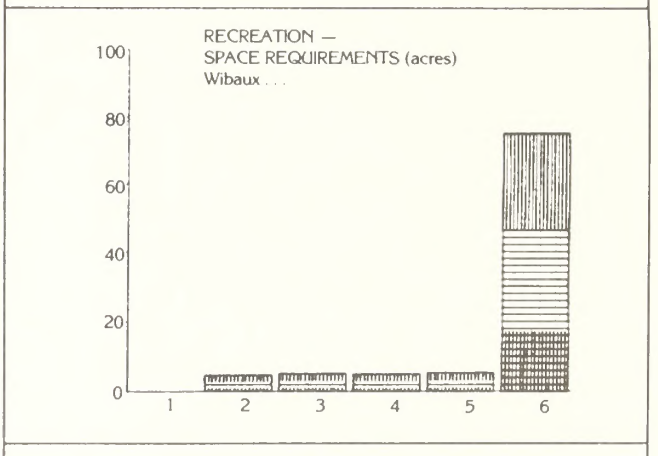
6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SPACE REQUIREMENTS (acres)
Wibaux . . .
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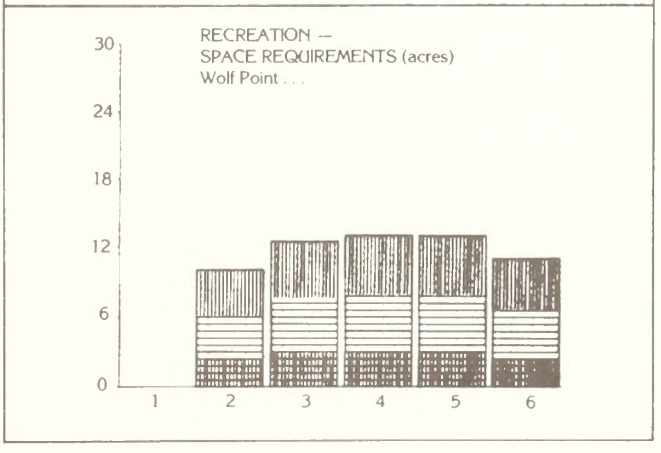
60
40
20
0
1
2
3
4
5
6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SPACE REQUIREMENTS (acres)
Wolf Point . . .
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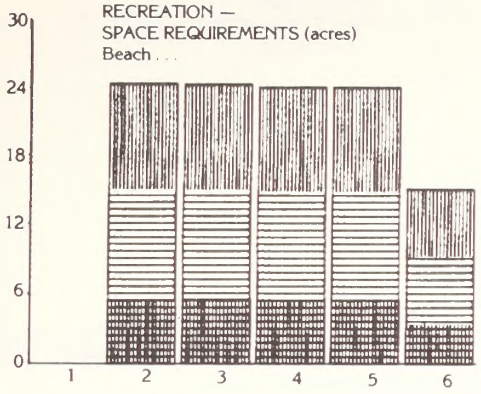
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SPACE REQUIREMENTS (acres)
Beach . . .
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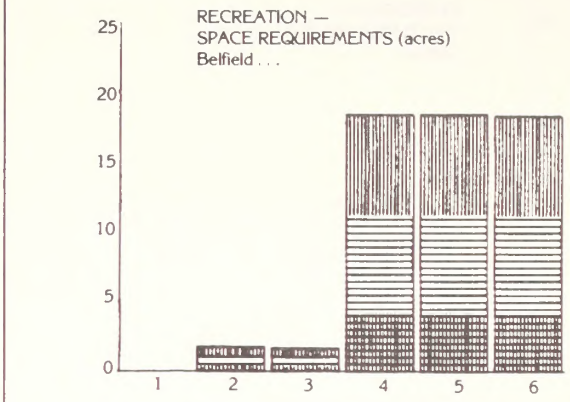
RECREATION —
SPACE REQUIREMENTS (acres)
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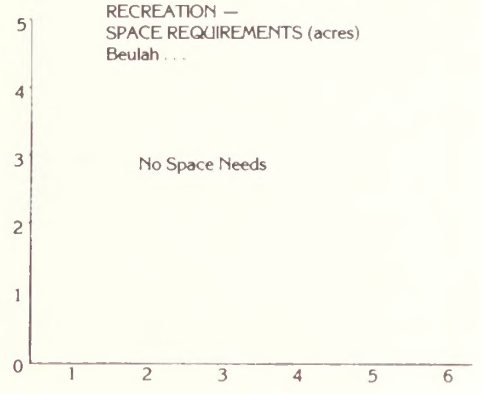
RECREATION —
SPACE REQUIREMENTS (acres)
Beulah . . .
No Space Needs
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1
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3
4
5
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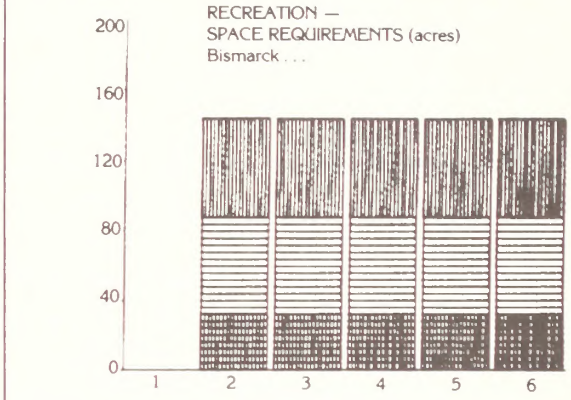
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SPACE REQUIREMENTS (acres)
Bismarck . . .
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120
80
40
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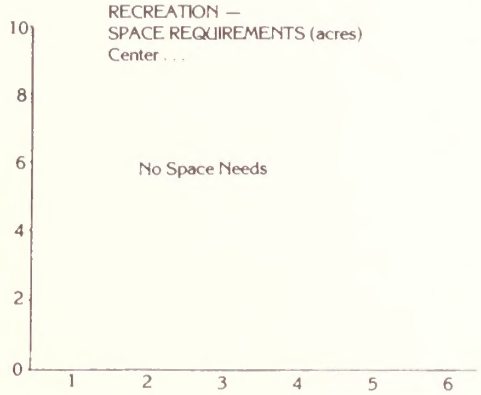
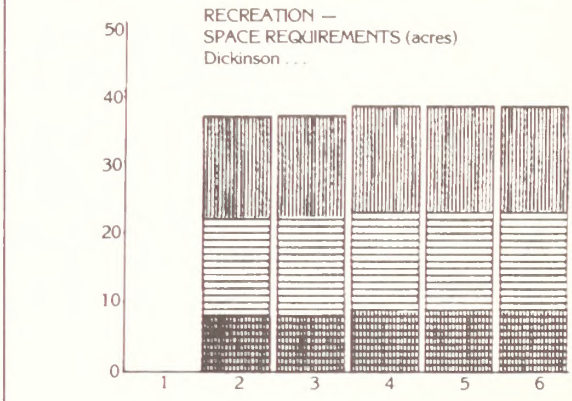

RECREATION —
SPACE REQUIREMENTS (acres)
Center . . .
No Space Needs
10
8
6
4
2
0
1
2
3
4
5
6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SPACE REQUIREMENTS (acres)
Dickinson . . .
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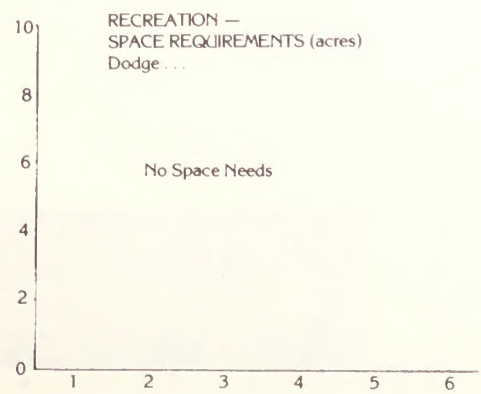
5
6


RECREATION —
SPACE REQUIREMENTS (acres)
Dodge . . .
No Space Needs
10
8
6
4
2
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2
3
4
5
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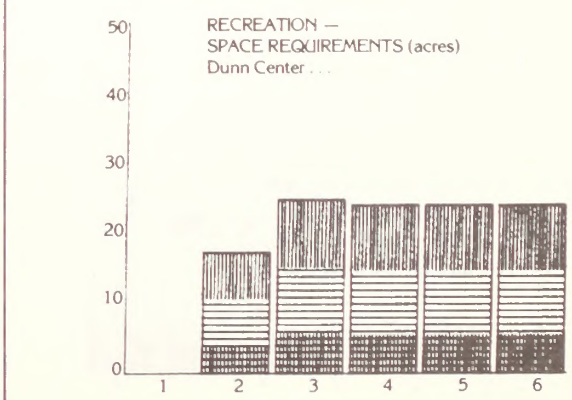
RECREATION —
SPACE REQUIREMENTS (acres)
Dunn Center . . .
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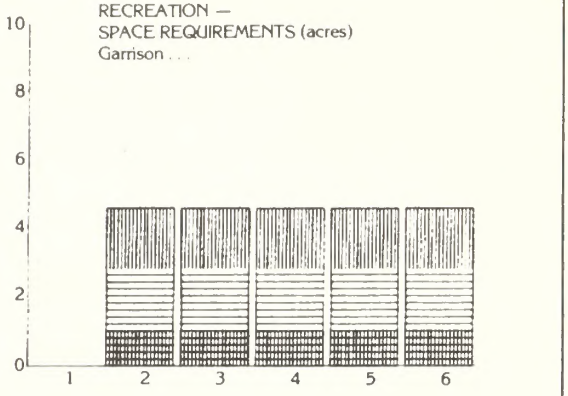
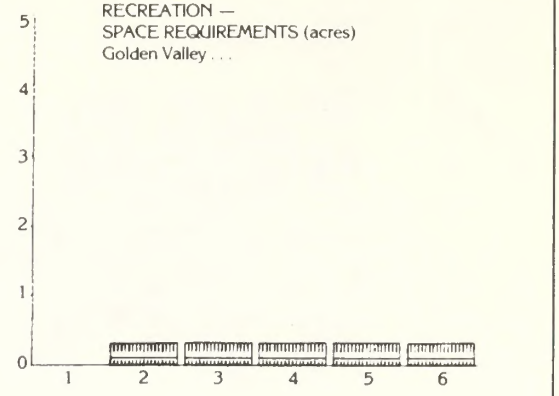
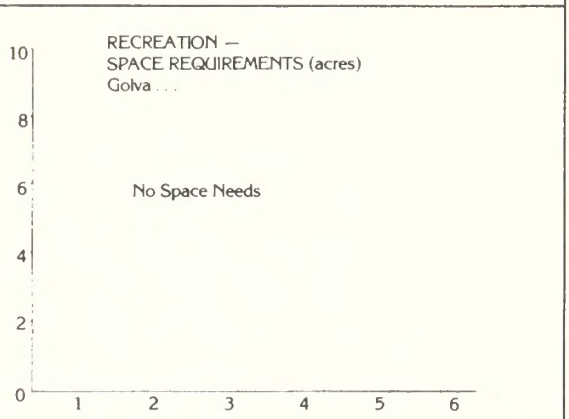
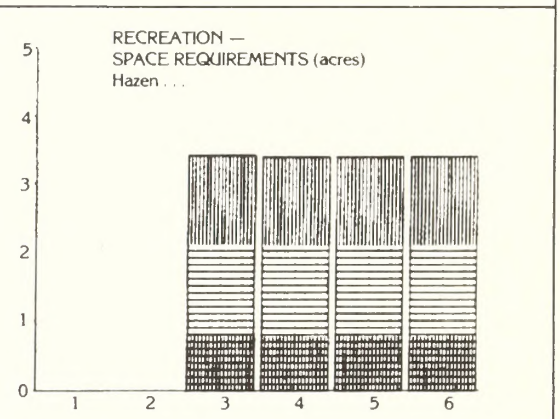
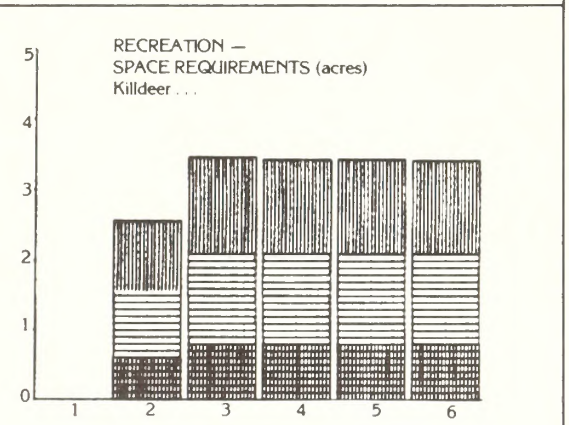
40
30
20
10
0
1
2
3
4
5
6

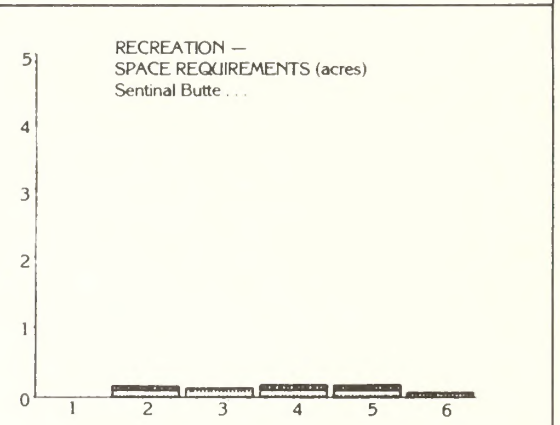

RECREATION —
SPACE REQUIREMENTS (acres)
Garrison . . .
10
8
6
4
2
0
1 2 3 4 5 6

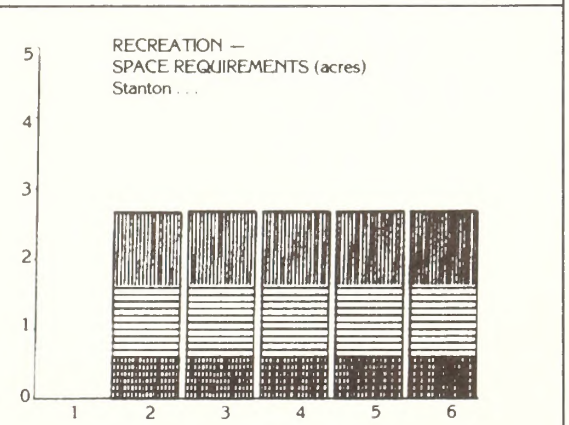

RECREATION —
SPACE REQUIREMENTS (acres)
Golden Valley . . .
5
4
3
2
1
0
1 2 3 4 5 6

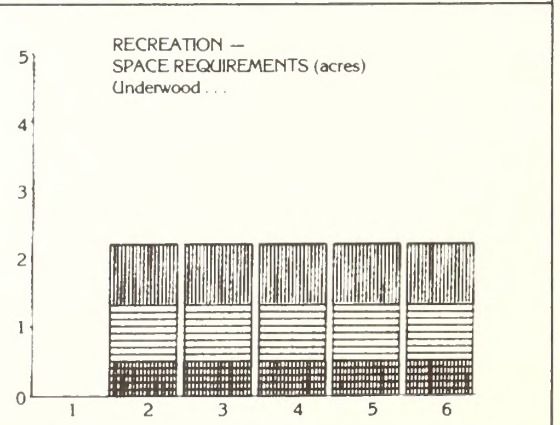

RECREATION —
SPACE REQUIREMENTS (acres)
Golva . . .
No Space Needs
10
8
6
4
2
0
1 2 3 4 5 6

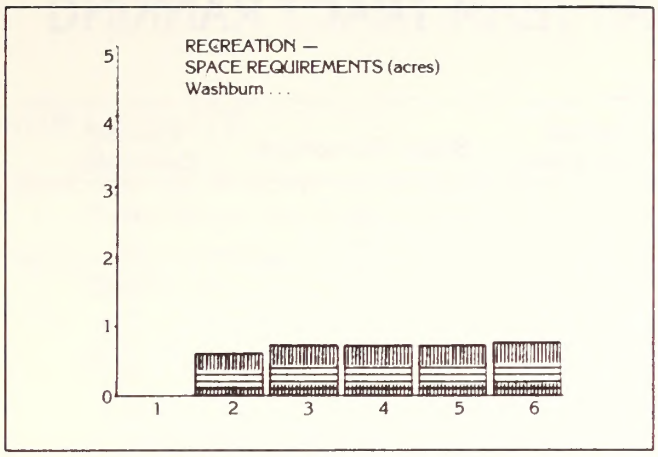

RECREATION —
SPACE REQUIREMENTS (acres)
Hazen . . .
5
4
3
2
1
0
1 2 3 4 5 6

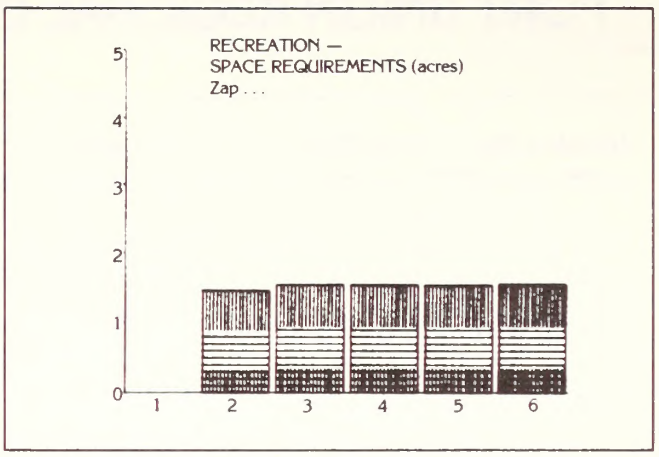

RECREATION —
SPACE REQUIREMENTS (acres)
Killdeer . . .
5
4
3
2
1
0
1 2 3 4 5 6


RECREATION —
SPACE REQUIREMENTS (acres)
Sentinal Butte . . .
5
4
3
2
1
0
1 2 3 4 5 6


RECREATION —
SPACE REQUIREMENTS (acres)
Stanton . . .
5
4
3
2
1
0
1 2 3 4 5 6


RECREATION —
SPACE REQUIREMENTS (acres)
Underwood . . .
5
4
3
2
1
0
1 2 3 4 5 6


RECREATION —
SPACE REQUIREMENTS (acres)
Washburn . . .
5
4
3
2
1
0
1
2
3
4
5
6


RECREATION —
SPACE REQUIREMENTS (acres)
Zap . . .
5
4
3
2
1
0
1
2
3
4
5
6

APPENDIX K

FORT UNION REGIONAL COAL TEAM TRACT RANKING

Ranking No.	Tract Name	Coal Economics	Natural Environment	Social Economics	Leasing Desirability
1	Truax	H	H	H	H
2	South Wibaux-Beach	H	M	M	H
3	Burns Creek	H	M	M	H
4	Sakakawea	M	M	H	H
5	Circle West I	H	M	M	H
6	Bloomfield	M	H	M	M
7	North Wibaux-Beach	H	M	M	M
8	Werner	M	M	M	M
9	Southwest Glendive	M	M	M	M
10	Dunn Center	H	M	M	M
11	Circle West III	H	M	L	M
12	Garrison	M	M	M	M
13	Circle West II	M	M	M	M
14	Central Bloomfield	L	H	M	L
15	Redwater I	M	M	L	L
16	Redwater II	L	M	M	L
17	Zenith	H	L	L	L
Production Maintenance/By-pass Tracts*					
	Antelope	H	H	H	H
	Center	H	H	H	H
	Glenharold	H	H	H	H
	North Beulah	H	H	H	H
	Renner	H	M	H	H
	Schoolhouse	H	H	H	H
	Underwood	H	H	H	H

*These tracts were not ranked in any order.

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Acid precipitation — Rainfall and/or snowfall having a higher degree of acidity than that which occurs naturally (because of naturally occurring carbon dioxide in the atmosphere), or whose acidity is caused by acidic constituents other than carbon dioxide.

Aerosol — A suspension of particles (solid or liquid) in the atmosphere.

Air basin — A geographical region in which air quality phenomena are Aelatively uniform and appreciably different from those outside the basin.

Albedo — The fraction of incident solar radiation which is reflected.

Alluvial valley floor — The unconsolidated stream laid deposits holding streams where water availability is sufficient for subirrigation or flood irrigation agricultural activities but does not include upland areas which are generally overlain by a thin veneer of colluvial deposits composed chiefly of debris from sheet erosion, deposits by unconcentrated runoff or slope wash, together with talus, other mass movement accumulation and windblown deposits.

Alluvium aquifer — Unconsolidated stream laid deposits which can store and transmit water in sufficient quantities for a specific use. Usually located in valley bottoms.

Ambient Air Quality Standards — The permissible level of various pollutants in the atmosphere, as contrasted with emission standards, the permissible level of pollutants emitted by a given source. For the federal government, these are known as National Ambient Air Quality Standards (NAAQS).

Annual arithmetic mean — An annual average of stated values.

Annual geometric mean — For a one year period, the nth root of the products of n values.

Aquifer — A zone, stratum, or group of strata that can store and transmit water in sufficient quantities for a specific use.

Assemblage — A group of activities that occur at one location.

Atmospheric deposition — The processes by which pollutants in the atmosphere are deposited on the earth's surface. There are wet deposition (e.g., acid rainfall) and dry deposition (e.g., dustfall) processes.

Atmospheric discoloration — A change in the color of the sky due to the presence of a pollutant. An example is a reddish brown color due to the presence of nitrogen dioxide.

Atmospheric stability — The tendency of the atmosphere to enhance or to suppress vertical motion within it. The former is an unstable condition, the latter is stable. Stability depends primarily on the change in atmospheric temperature with altitude.

Baseline — In reference to the regulation of the prevention of significant deterioration (PSD) of air quality, baseline is the existing level of a given pollutant for a given area to which the allowable PSD increment is added. The baseline usually is established when the first application for a PSD permit in the area is filed.

Boiler bottom ash — The inorganic residue deposited as a calcium or other salt scale produced during the generation of steam in a boiler.

Box cut — A method of opencast mining of coal where the dip of the seam is relatively steep. A boxlike excavation resulting in a highwall on both sides of the cut which is made to the dip, or at an angle to it; and the coal seam is worked to the right and left.

Cairns — Rock structures of relatively small diameter possibly used in marking boundaries or as blinds in hunting game, or as religious monuments.

Ephemeral — A stream which flows only in direct response to precipitation in the immediate watershed or in response to the melting of a cover of snow and ice, and which has a channel bottom that is always above the local water table.

Fly ash — Fine solid particles of noncombustible ash with or without accompanying combustible particles carried out of a bed of solid fuel by the draft and deposited in quiet spots within a furnace and flues or within a boiler setting, or carried out of a chimney with the waste gases and often recovered for use as a constituent in commercial products.

Gaseous precursor emissions — Refers to air pollutants emitted into the atmosphere as gaseous compounds (e.g. sulfur dioxide) which subsequently may be converted to different pollutant species, gaseous, liquid or solid (e.g. sulfates from sulfur dioxide).

Gasifer ash — The inorganic residue after the incineration of coal in the gasification process.

Gas purification sludge — The heavy sediment deposit resulting from the gas purification step in the Lurgi gasification methodology.

Glacial meltwater channel (buried) — A valley formed by streamflow resulting from melting glaciers. Subsequent advances of glaciation may have filled these valleys with debris creating buried meltwater channels.

Groundwater — A subsurface water that fills available openings in rock or soil materials to the extent that they are considered water saturated.

Hydrology — The science that deals with the occurrence and behavior of water in the atmosphere, on the ground and underground.

Impermeable — Rock sediment, or soil that is incapable of transmitting fluids under pressure.

Increment — In reference to the regulation of the prevention of significant deterioration (PSD) of air quality, the increment is the maximum allowable increase in the level of pollution, over and above the existing baseline level. PSD increments are categorized as Class I, II, and III, according to the increasing magnitude of allowable concentrations.

Integral vista — A view from within a Class I area, extending outside the area's boundaries, which is important to the visitor's visual experience of the Class I area itself. Integral vistas associated with mandatory federal Class I areas are protected under the Clean Air Act.

Inversion — An increase in air temperature with increasing height above the ground. This is a stable atmospheric condition.

Ion — An atom or group of atoms which has gained or lost one or more electrons, and therefore has acquired an electric charge.

Lignite — A brownish-black coal that is intermediate in coalification between peat and subbituminous coal; consolidated coal with a calorific value less than 8300 British thermal units per pound, on a moist, mineral-matter-free basis.

Lithic cache — A deposit of quarried stone which has been placed by man for further use, can be rough stone material to finished product.

Lithic material — A stone which is utilized by man for a purpose.

Lithic procurement — An area utilized as a source for stone which has particular merit for making stone tools.

Lithic scatters — A relatively small area defined by stone that has been worked by man for use as tools or stone flakes from the making of tools.

Lithosphere — The earth's crust, rock and soil.

Microcurie, uCi — A unit of radioactivity intensity corresponding to 3.7×10^4 nuclear transformations per second.

Microphysical — Pertaining to physical processes or materials on a microscopic scale; for example, involving dust particles.

Mine pit — An opening or excavation in the earth for the purpose of extracting minerals; surface mining where the workings may be known as a strip pit or workings by the open-cut method to obtain material of value.

National Register of Historical Places — A listing of any district, site, building, structure or object which merits historic preservation and includes properties of national, state, and local significance. The Register is administered by the Advisory Council on Historic Preservation and Contains seven cabinet rank members.

Overburden — All the earth and other materials which lie above a natural deposit of minerals.

Peak annual flow — The highest discharge through a stream channel over a period of a year.

Perennial stream — A stream that flows continuously during all of the calendar year as a result of ground water discharge or surface runoff.

Photochemical oxidants — Strongly oxidizing chemical species, usually highly reactive and irritating to sensitive organs, produced in the atmosphere from certain air pollutants under the influence of sunlight; includes ozone, nitrogen dioxide and others.

Physiographic zones — An area all parts of which are similar in geologic structure and climate and which has consequently had a unified beginning in time; an area whose pattern of relief features or landforms differs significantly from that of adjacent areas.

Porcelainite — Stone of tool making quality composed of material fired over naturally burning coal beds.

Preglacial channel (buried) — A valley formed by streamflow which was present before glaciers moved across North Dakota. As glaciers advanced they filled these valleys with debris creating buried channels.

Prehistory — The period of time before contact with anglo-american culture, of or belonging to the time before history or events were recorded in writing.

Prevention of Significant Deterioration (PSD) — A regulatory program based not on the absolute levels of pollution allowable in the atmosphere but rather on the amount by which present air quality will be allowed to deteriorate in a given area.

Radionuclide — A radioactive chemical element or isotope.

Radon 220 — A radionuclide.

Radon 222 — A radionuclide.

Retrofit — In the air pollution control context, the application of air quality control technology to existing sources, as opposed to achieving air quality control through initial system design.

Social organization — The formal and informal structures and processes (ways of doing things) which organize how people in a community relate to each other, both individually and in groups. A part of social organization is the concept of culture, or traditions, ideas and values which a community shares.

Social well being — Expectations of conditions that should exist in one's life, such as freedom from crime or access to public service.

Spoils/spoil pile — The overburden and interburden removed in strip mining. Debris or waste material from a strip mine.

State Implementation Plan (SIP) — A state regulatory program, approved by the U.S. Environmental Protection Agency, under which the state is delegated full authority to regulate air quality on lands under its jurisdiction.

Stone alignments — Prehistoric or historic rock configurations of unknown purpose, can be circles, or linear arrangements.

Sub-bituminous — A class of coal; intermediate in heating value between bituminous (higher) and lignite (lower).

Subsistance strategy — A set of behaviors used by man to support his lifeway.

Temperature inversion — A meteorological phenomenon in which the temperature of the atmosphere increases with altitude, as opposed to the normal condition in which the temperature decreases at increasing altitude.

Thorium — A radionuclide.

Till aquifer — Unconsolidated mixture of clay, silt, sand, gravel and boulders deposited by a glacier which can store and transmit water in sufficient quantities for a specific use.

Total dissolved solids — The quantity of chemical material which is dissolved in a particular body of water. This is a measure of the general chemical quality of that water.

Total Suspended Particulates (TSP) — All particulate solid and liquid matter, except water, suspended in the atmosphere; includes dusts, smoke particles, pollen particles, and liquid or solid aerosols.

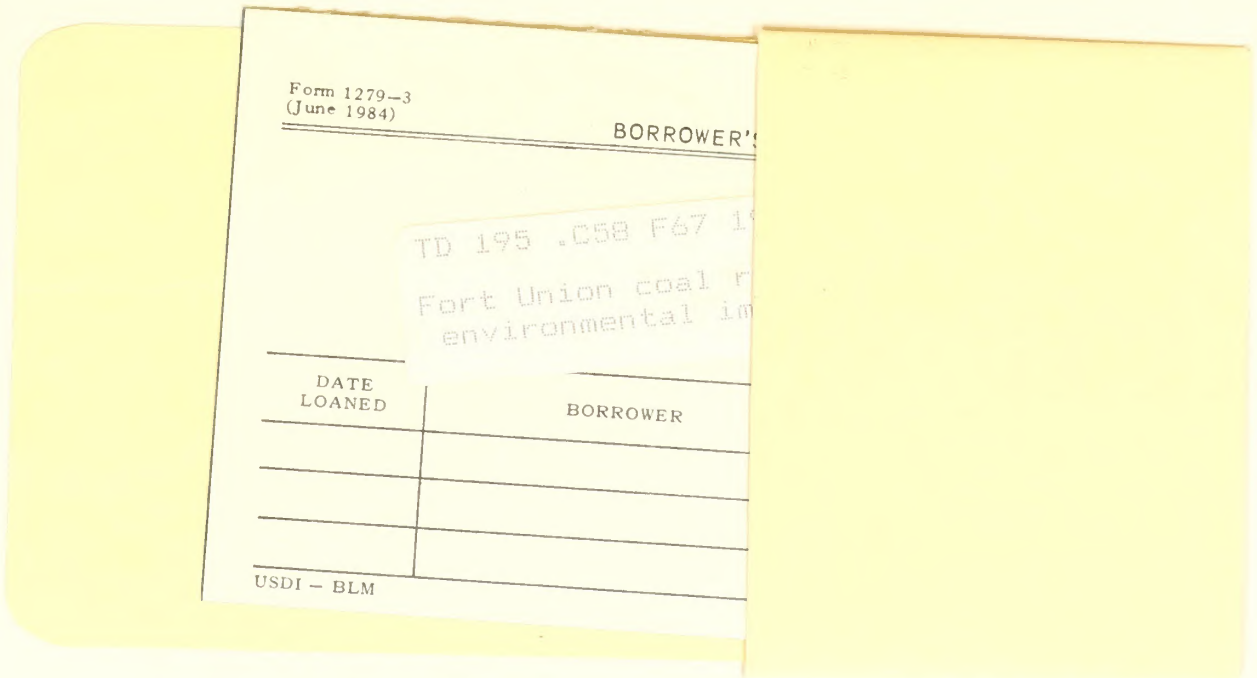
Uranium — A radionuclide.

Visibility — A measure of: (1) the distance that objects can be seen (visual range), and (2) the contrast between an object and its surroundings. A reduction in visibility will reduce the distance that objects can be seen and will reduce the contrast between an object and the horizon.

Visual range reduction — An increase in general haze in the atmosphere.

Water table — The upper surface of a zone of saturation, where the body of ground water is not confined by an overlying impermeable zone.

Wind rose — A diagram showing the distribution of wind direction experienced at a given location. It most commonly consists of a circle from which 8 to 16 lines emanate, one for each compass point. The length of each line is proportional to the frequency of wind from that direction.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MONTANA

NORTH DAKOTA

TRACT NAMES

1 Bloomfield Tract
2 Burns Creek Tract
3 Central Bloomfield Tract
4 Circle West I Tract
5 Circle West II Tract
6 Circle West III Tract
(tract is composed of Circle West I and Circle West II)
7 North Wibaux-Beach Tract
8 Redwater I Tract
9 Redwater II Tract
10 South Wibaux-Beach Tract
11 Southwest Glendive Tract
12 Antelope Tract
13 Center Tract
14 Dunn Center Tract
15 Garrison Tract
16 Glenharold Tract

MINE AND CONVERSION FACILITY NAMES

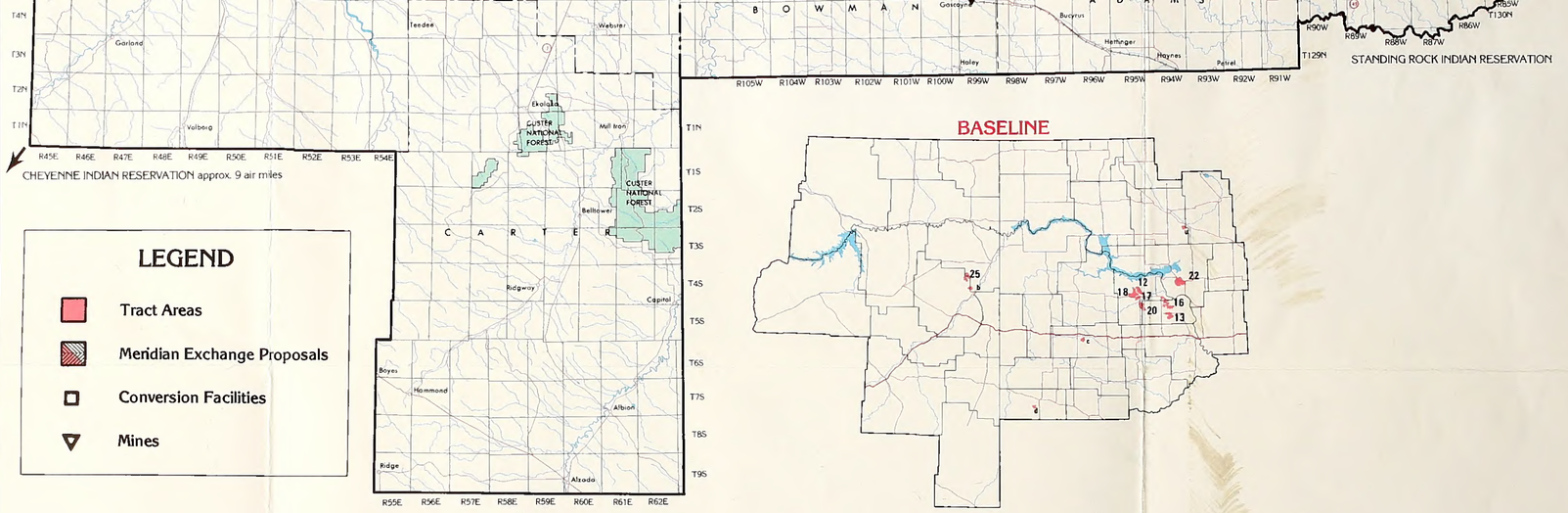
a Lewis & Clark Power Plant
b Savage Mine
c Husky Mine; Husky Briquetting Plant
d Gascoyne Mine
e Beulah Hazen Mine
f Indianhead Mine
g Coyote Power Plant
h Beulah Mine

BASELINE

CHEYENNE INDIAN RESERVATION approx. 9 air miles

STANDING ROCK INDIAN RESERVATION

1. Redwater II Tract
2. South Wibaux-Beach Tract
3. Southwest Glendive Tract
4. Antelope Tract
5. Center Tract
6. Dunn Center Tract
7. Garrison Tract
8. Glenharold Tract
9. North Beulah Tract
10. Renner Tract
11. Sakakawea Tract
12. Schoolhouse Tract
13. Truax Tract
14. Underwood Tract
15. Werner Tract
16. Zenith Tract
17. Woodson Tract
18. Meridian Exchange North (BLM coal to Meridian)
19. Meridian Exchange South (Meridian coal to BLM)



LEGEND

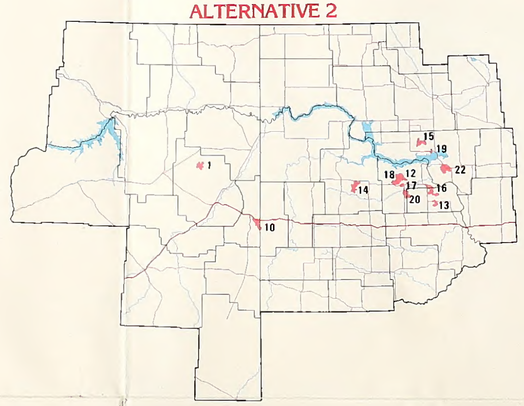
- Tract Areas
- Meridian Exchange Proposals
- Conversion Facilities
- Mines

BASELINE

a Lewis & Clark Power Plant
b Savage Mine
c Husky Mine; Husky Briquetting Plant
d Gascoyne Mine
e Beulah Hazen Mine
f Indianhead Mine
g Coyote Power Plant
h Beulah Mine
i Great Plains Coal Gasification Plant
j Antelope Valley Power Plant
k Garrison Hydroelectric Plant
l Falkirk Mine
m Coal Creek Power Plant
n Stanton Power Plant
o Leland Olds Power Plant
p Glenharold Mine
q Milton Young Power Plant
r Center Mine
s Heskett Power Plant
t Neal Power Plant
u Velva Mine

ALTERNATIVE 1

ALTERNATIVE 2



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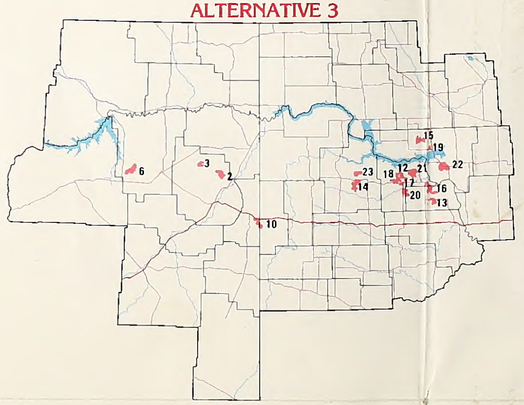

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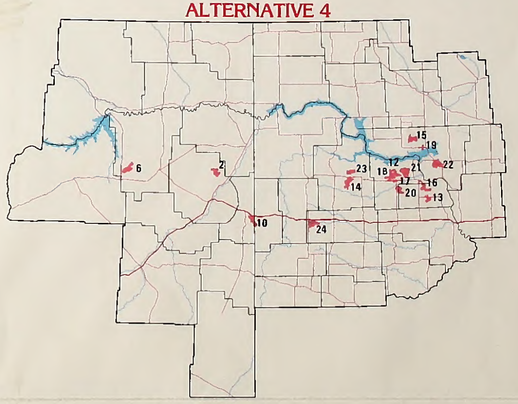

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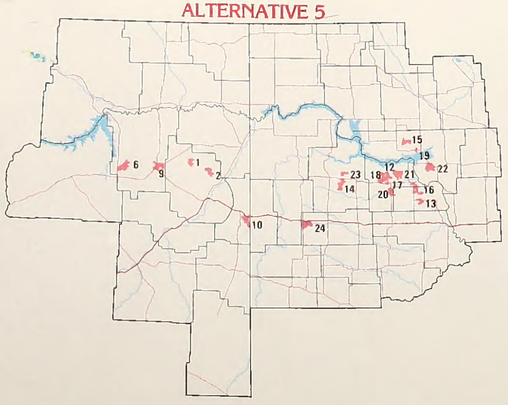

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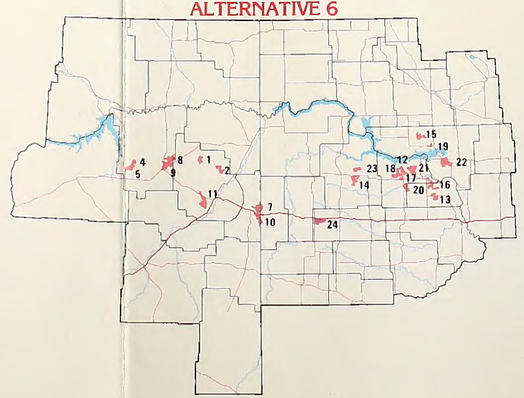
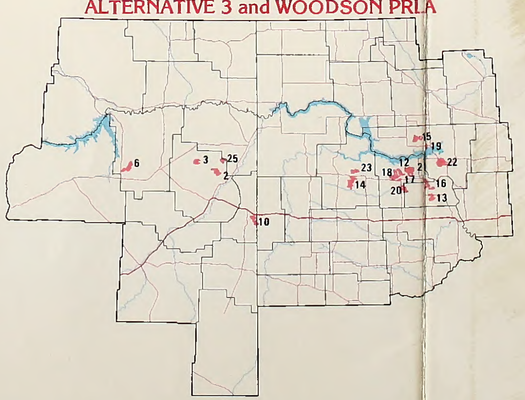
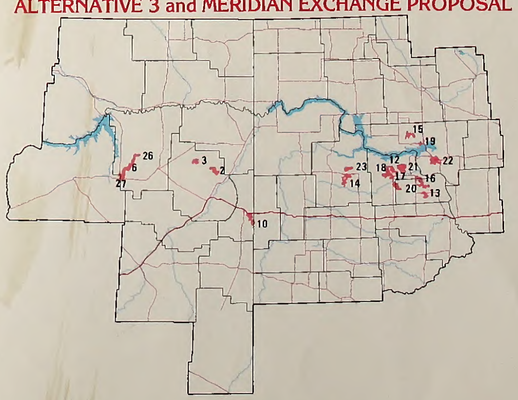


ALTERNATIVE 3 and WOODSON PRLA



ALTERNATIVE 3 and MERIDIAN EXCHANGE PROPOSAL



MAP 1

FORT UNION COAL REGION — PROPOSED LEASING ALTERNATIVES